

UNDERSTANDING TEACHERS' EXPERIENCES
IMPLEMENTING PROJECT-BASED LEARNING

A Record of Study

by

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ABSTRACT

Project-based learning (PBL) is a constructivist approach to instruction in which students are challenged to address a problem without sufficient knowledge at the outset to solve the problem. PBL models generally include a driving question, focus on real-world issues, require student inquiry and collaboration, allow for student choice, and result in the completion of a product. PBL could be considered a disruptive innovation within public education in the sense that it does not accord with existing social systems—beliefs, values, and shared commitments—that exist in most schools and it provides learners opportunities they do not otherwise have access to in school. The purpose of this record of study was to document how a group of teachers implemented a PBL instructional initiative, identify the extent to which teachers' beliefs aligned with their practices, and learn how the organization's social systems impacted the implementation.

This record of study employed a case study approach that focused on four junior high school teachers who implemented a PBL instructional model in their classrooms. Data analysis found that the most frequently used practices were: students working in a planned cooperative structure; teachers interacting with small groups of students; students in small groups discussing facts, ideas, and solutions; and students using the Web for research. Second, teachers indicated that they believed their practices aligned with constructivist principles overall while observations indicated teachers' practices reflected low-intermediate agreement with constructivist principles. Finally, the data analysis revealed teachers considered the principal a central figure for driving the

implementation of PBL, making power and authority the feature systemic motivation for implementation. The analysis also found that teachers found the school's student-centered instructional mission to be an important influence, although it was mediated by their beliefs regarding the students' participation in the PBL environment.

DEDICATION

This record of study is dedicated to my wife, Laura, and our son, Reid. Without you guys, I could only have imagined. Thank you for the inspiration. I love you.

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I would like to acknowledge those closest to me, personally and professionally, who have supported this effort.

Thank you to my colleagues in public education who have promoted and supported a culture of learning. To inspire learning in others, we must always be learners ourselves. Thank you to the faculty in the Department of Teaching, Learning, and Culture at Texas A&M University, most especially those who served on my committee and helped me complete this work.

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I'll never stop learning, but I am finished being a student... probably.

NOMENCLATURE

CCOF	Constructivist Classroom Observation Form
CLEQ	Constructivist Learning Environment Questionnaire
KDT	Knowledge Development and Transmission
NAEP	National Assessment of Education Progress
PBL	Project-based Learning
PISD	Progressive Independent School District
RHC	Raising Healthy Children
RSVP	Responsible Students, Volunteers, Parents
SBSDN	Standard-Bearer School District Network
SDT	Self Determination Theory
SRL	Self-regulated Learning
THPSC	Texas High Performance Schools Consortium

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CHAPTER I

INTRODUCTION

Progressive Independent School District (PISD) began implementing project-based learning (PBL) at its junior high school campus in the fall of 2013. PBL is a constructivist approach to instruction in which students are challenged to address a problem without sufficient knowledge at the outset to solve the problem. Students are asked to assume greater responsibility for leading the learning process while teachers become facilitators rather than sole arbiters of knowledge and pedagogy (Hmelo-Silver & Barrows, 2006). PBL models generally include a driving question, focus on real-world issues, require student inquiry and collaboration, allow for student choice, and result in the completion of a product (Bender, 2012; Ertmer, Simons & Simons, 2006; Savery, 2006). While PBL is supported by research in the areas of student learning and achievement, motivation, and engagement, it does not represent the typical pedagogical approach in most school systems today. Teachers using PBL devise learning environments that are consistent with their pedagogical understanding of constructivist learning theory (Savery & Duffy, 1995). Furthermore, teaching and learning in schools is influenced by the social systems that define behavior within all organizations. Social systems include the directional system, the knowledge development and transmission system (KDT), the recruitment and induction system, the boundary system, the evaluation system, and the power and authority system (Schlechty, 2009). PBL requires systems that promote students taking ownership of learning and teachers using PBL

protocols in ways that support constructivist principles. Systems design, including those that influence teacher professional development, should focus on how teachers might transform their perspectives on teaching and learning to align the implementation of PBL with constructivist principles so that PBL truly represents instructional innovation (Pecore, 2009). PISD system designers need to learn how the district's social systems impact teachers' implementation of PBL, how teachers' practices align with constructivist principles, and what practices teachers use to implement PBL.

Justification

Several processes revealed PISD lacked understanding about how its organizational social systems affect teachers' implementation of instructional innovations. These processes included a curriculum management audit, teacher focus-group data collection, stakeholder reflection around the Schlechty Center's System Capacity Standards, and strategic planning.

Curriculum management audit. A district curriculum management audit conducted in 2007 revealed the school district lacked processes for providing direction for organizational improvement, including formal processes regarding instructional strategies and interventions as well the professional growth of its teachers. Also, the audit found the district lacked comprehensive evaluation processes to inform the continuation, adjustment, or termination of programs and practices (Jacob & Shidaker, 2007).

Teacher focus-groups. In response to curriculum management audit findings that the district lacked an aligned curriculum, PISD adopted the CSCOPE curriculum

management system produced by the Texas Education Service Center Curriculum Collaborative (TESCCC). The scope and sequence established by CSCOPE was designed to accommodate the inquiry-based, 5E Model of Instruction which the district promoted with the adoption of CSCOPE. Data collected through teacher focus-groups revealed confusion about the use of the 5E Model of Instruction. Focus-group data also showed teachers had concerns about not having enough resources to support inquiry learning, not having the time to plan and implement inquiry learning, and that students lacked capacity to participate in inquiry-based learning environments (Powers, 2011). Furthermore, classroom observation data showed the 5E Model of Instruction was not being used by teachers.

System capacity standards. In 2012, PISD joined the Standard-Bearer School District Network (SBSDN), a network of public school districts that use the Schlechty Center's System Capacity Standards to assess organizational capacity to support change. This work involves analyzing a school district's social systems (the set of relationships between and among rules and roles that define behavior with the district) and how these systems either support or inhibit innovation. The system capacity standards analyzed by the district included 1) developing a shared understanding of the need for change, 2) developing shared beliefs and vision, and 3) developing a focus on students and the quality of work provided to students (Schlechty, 2009). Through work in the district, facilitated by Schlechty Center consultants, consensus formed among participants, including administrators, teachers, the PISD Board of Trustees, and community members, that learning is situated in a context that is larger than the classroom or school.

Also, participants agreed that students value the intrinsically motivating elements of autonomy, competence, and relatedness in school work and that these elements could contribute to increased student engagement and achievement if they could be accounted for in the work students do at school (Powers, 2013; Schlechty, 2011).

Strategic planning. Finally, in 2010, the school district completed a comprehensive strategic planning process that included teachers, administrators, staff members, parents, and community members. The Progressive Independent School District Strategic Plan was revised in 2013 to carry it through its final two years. The plan requires the design of professional development activities to support the implementation of PBL (Progressive Independent School District Strategic Plan, 2013).

Setting

Progressive is a pseudonym for a rural school district in central Texas with a diverse student population and a large percentage of students classified as economically disadvantaged. Students classified as economically disadvantaged are those that qualify for free or reduced-price lunch. District-wide, 46.1% of students are Hispanic, 28% are White, and 24.6% are African-American. More than 77% of students are economically disadvantaged and 62.2% are classified as at-risk for dropping out of school. There are five schools (one high school, one junior high school, and three elementary schools). This record of study took place at the junior high school where the student body comprises 44.2% Hispanic students, 31.2% White, 23.8% African-American, and 74.1% of the students are economically disadvantaged. There are 44 teachers in the school, 86.4% who are White, 9.1% who are African-American, and 2.3% who are Hispanic. A

plurality of the staff, 39.5%, has between 1-5 years of teaching experience while 14.2% have between 6-10 years experience, 15.9% have between 11-20 years experience, and 23.7% have more than 20 years of experience. The junior high school was labeled Academically Unacceptable in Texas' Academic Excellence Indicator System in 2011. In 2013, the school achieved Met Standard, according to the Texas Academic Performance Report. Texas public schools did not receive a rating based on the 2012 school year testing data. The school uses the CSCAPE curriculum management system in the core subject areas of English, math, science, and social studies. Also, during the 2011-2012 school year, the junior high school implemented technology applications courses in grades 6-8. These courses essentially constituted a fifth core area as all students are required to take a technology applications course in each of their junior high school years. The purpose of these courses was to enhance students' technology applications skills and to provide a context for cross-disciplinary work that would be informed by technology applications skills.

Finally, teachers who implemented PBL participated in instructional design seminars in the year prior to implementation that focused on design specifications, promoted by the SBSDN and the Schlechty Center, that align with constructivist learning principles. Also, the school district developed a plan to upgrade the district's technology infrastructure to better support PBL. The upgrade was intended to put the district in a position to provide a 3:1 student-to-computer ratio in PBL instructional environments while also allowing students to bring their own devices for accessing the Internet. The district also purchased mobile devices through a technology lending

program grant that was designed to ensure economically disadvantaged students have access to personal devices for use in school.

Youth development grant. The junior high school participates, along with the other four schools in the district, in a federally funded grant program locally called the Responsible Students, Volunteers, and Parents Program (RSVP). RSVP is modeled on the Raising Healthy Children (RHC) approach to youth development formerly known as the Seattle Social Development Project. The RHC approach is grounded in a 30-year longitudinal research study that has identified predictors of positive student outcomes including academic achievement and commitment to school (Hawkins, Kosterman, Catalano, Hill, & Abbott, 2008). In addition to parental support initiatives, campus program coaches provide support to school staff in developing and strengthening skills in the areas of classroom management, instruction, cooperative learning, and student motivation.

Record of Study Mentor

The field-based mentor for this record of study was the superintendent of schools. The superintendent appointed me to facilitate the district's work with the SBSDN. He also appointed me to facilitate the development and the work of the school district's design team and leadership academy, the two committees that are focused on system capacity standards and the design of the district's social systems to support instructional innovation.

Researcher Qualifications/Participation

I am currently the school district's chief learning officer. My major responsibilities include:

- serving on the superintendent's leadership team;
- directing the district's curriculum and instruction services;
- participating in and leading organizational improvement processes;
- providing leadership of professional development and training programs for all staff members including current and prospective administrators;
- assisting with budget development and management;
- and working within the community to represent the school district.

I served as the district's instructional technology coordinator for almost four years prior to my current assignment. I was a high school teacher for 11 years. I advised the high school's publications and taught journalism, technology applications, audio/video production, graphics design, and photography. As the instructional technology coordinator, I was responsible for facilitating the integration of technology into curriculum and instruction which included planning and conducting professional development and assisting with the management of the school district's technology infrastructure.

Research and experience have influenced my perspective on the implementation of PBL and, undoubtedly, influenced how I viewed its implementation through the experiences of the participant teachers. In observing teachers implementing PBL, my assumption is that student engagement is something over which teachers have control

because they control the design of work and how they interact with students. While this represents a belief, albeit one based in research and experience, it may or may not be shared by the participants. Also, I believe teachers' expectations for students have an impact on their design of learning environments. This can impact the implementation of PBL for better or worse. As a district administrator, the evaluation of a previous pedagogical framework based on inquiry and active student participation showed that one of the limiting factors associated with its use was teachers' beliefs that students lacked capacity to participate in inquiry-based activities. Finally, I see my professional role as one of support for principals and teachers. I do not evaluate teachers directly. Campus administrators do that. However, I do interact with teachers and worked with participant teachers on issues related to PBL implementation. An example is dealing with the dilemma of student work groups. One teacher, during the semester's first project, was not sure how to handle the fact that various groups were at different places in the learning process and, therefore, were not ready to advance to the next PBL protocol at the same time. Her dilemma was how to reconcile this with the inevitable need to move the class forward. We discussed it, I made a suggestion, and she liked the idea for this particular project. So, in working with teachers, there are examples of issues I may influence that inform their practice.

Literature Review

Gallup research shows that engagement in school declines as students get older, a concerning trend more than a decade after the No Child Left Behind Act became the nation's standard for defining and measuring student success (Gallup, 2012). Many

states have asserted greater control in determining what student learning should look like and in accounting for its measurement, most notably through high-stakes, standardized tests. This has led many local education providers to standardize instructional design. Yet while scores on the National Assessment of Education Progress (NAEP)—the primary national assessment of student learning—are higher today than at its inception, there is an impression that public education is failing (Rampey, Dion & Donahue, 2009). This is perhaps attributable to declining student engagement. Many students do not experience school as personally relevant. While NAEP scores have improved, scores in creative thinking measures have declined in the last 20 years (Kim, 2011). Furthermore, increases in NAEP scores diminish as the age of tested students increases, taking on a similar pattern to measures of student engagement. Students who are engaged find meaning and value in the work they do in school. Instructional designs that incorporate a product-focus, affirmation, affiliation, novelty and variety, choice, and authenticity are more likely to embody the intrinsically motivating tasks and activities that appeal to students and facilitate engagement in academic learning (Finn & Zimmer, 2012; Reeve, 2012; Schlechty, 2011; Schunk & Mullen, 2012).

In 2011, the 82nd Texas Legislature established the Texas High Performance Schools Consortium (THPSC), a group of school districts that are working together to transform public schools through the implementation of a transformational teaching framework that would reframe assessment to include values reflected in innovative, student-centered approaches to instructional design (Texas Association of School Administrators, 2012). In 2013, Progressive ISD joined the THPSC as it expanded its

network to other school districts. The term, transformational teaching, represents a super-ordinate framework of contemporary instructional approaches connected conceptually by the reliance upon constructivist principles for designing learning experiences for students (Rosebrough & Leverett, 2011; Slavich & Zimbardo, 2012).

Constructivism is an epistemological concept underlying theories of how people and organizations learn. Individuals and organizations bring experiences and beliefs into the process of learning. Learning occurs as perspectives and new ideas are mediated through inquiry, reflection and work with others (Lambert, Walker, Zimmerman, et al., 2002). PBL is a constructivist approach to instruction in which students are challenged to address a problem without sufficient knowledge at the outset to solve the problem. Emphasizing self-directed learning (SRL), supported by teacher scaffolding, students in PBL environments use inquiry to apply, often collaboratively, what they have learned to create a product, performance, or presentation (Bender, 2012; Ertmer, Simons & Simons, 2006; Savery, 2006; Schlechty, 2011; Schmidt, Loyens, Van Gog, & Paas, 2007; Yew & Schmidt, 2011). PBL requires students to spend time involved in reflective abstraction, something often missing in schools where the emphasis is on knowledge gathering (Kim, 2011). Perceptions of autonomy, competence, and relatedness within a particular instructional setting inform students' level of engagement in school, and PBL protocols align with aspects of human psychology that inform motivation. Self-determination theory (SDT) asserts that self-regulation and self-motivation are driven by the psychological needs to feel autonomous, competent, and emotionally connected to others (Cordova & Lepper, 1996; Deci, Koestner, & Ryan,

1999). PBL's emphasis on student choice, product-focus, and collaboration can accommodate these needs (Park, Holloway, Arendtsz, Bempechat, & Li, 2012). Also, a consistent finding in the research is that PBL environments facilitate greater student motivation and engagement and improve students' disposition toward learning (Faessler, Hinterberger, Dahinden, & Wyss, 2006; Hmelo-Silver, 2004). Additionally, feeling connected to students (relatedness) is a predictor of workplace engagement among teachers, and it facilitates higher levels of enjoyment and lower levels of anxiety, anger, and emotional exhaustion (Klassen, Perry, & Frenzel, 2012). Teacher interaction with students is predictive of teacher engagement and, to the extent teachers are able to spend more time with students individually, of student performance as well (Bloom, 1984). Finally, PBL has been found to facilitate greater long-term comprehension and application, greater achievement motivation, enhanced bonding to school, and even better scores on standardized tests (Scales, Roehlkepartain, Neal, Kielsmeier, & Benson, 2006; Strobel, 2009; Summers & Dickinson, 2012; Wirkala & Kuhn, 2011).

PBL does not represent new thinking in education. The idea that learning is social, interactive, and grounded in how students experience the world and curriculum can be traced back to the early 20th century (Dewey, 1938; Piaget, 1926; Vygotsky, 1978). The recent reemergence of PBL in the education discourse is attributable to the power of today's technology to accommodate student activity in the formal learning environment. Computer processing speed and digital memory capacity have been developing at exponential rates for more than 50 years, facilitating the development of communications technologies that have provided platforms for mass publishing,

communication, collaboration, collective action, and learning (Shirky, 2006).

Technology has allowed for a reconsideration of inquiry-based learning in schools by facilitating student access to the outside world, allowing them to bring real-world problems into the classroom and apply knowledge to real-world situations in a safe environment (Bransford, Brown, & Cocking, 2000; Brush & Saye, 2008).

PBL environments differ significantly from traditional, teacher-centered environments. In Progressive ISD, the implementation of PBL was intended to emphasize depth in standards-based learning with the goal of facilitating student engagement and achievement through work that is relevant and meaningful to the learner, meets or simulates an actual need in the world beyond the classroom, and facilitates the development of skills related to critical thinking, communication, collaboration, and creativity. The implementation of PBL poses difficulties for teachers that are unfamiliar with the new roles and responsibilities that exist in inquiry-based learning environments (Garet, Porter, Desimone, Birman, & Yoon, 2001; Land, 2000). Students in PBL classrooms assume greater responsibility for their learning while teachers become facilitators, guiding and assessing the learning, rather than the sole arbiters of knowledge and process (Hmelo-Silver & Barrows, 2006). Also, while technology may be making PBL more accessible in schools, teachers must understand how to interact with technology and integrate it into instructional design. Teachers whose pedagogical beliefs align with constructivist principles are more likely to integrate technology for the purpose of facilitating active, student-centered learning experiences and are more likely to adopt PBL protocols that are consistent with

constructivism (Liu, Wivagg, Geurtz, Lee, & Chang, 2012; Park & Ertmer, 2008). A lack of technology-supported pedagogical and classroom management skills are among the largest barriers to effective integration (Hew & Brush, 2006; Walker, Recker, Osen, & Leary, 2011). Furthermore, lack of teacher training, insufficient equipment, and limited high quality access to the Internet have been inhibiting factors for teachers implementing PBL in K-12 environments (Kramer, Walker, & Brill, 2007).

Teachers have held beliefs about pedagogy and about the roles of teachers and students in the educational process. Furthermore, the relationship between teachers' beliefs and practices, as well as the social context in which teachers work, has implications for understanding how teachers implement instructional innovations. Teachers implementing PBL design instruction that is consistent with their knowledge of constructivist learning principles (Savery & Duffy, 1995). The use of a constructivist teaching model can require teachers to adopt practices that run counter to traditional notions of teaching and learning. While improvement in student learning is the goal of any attempt at instructional reform, success depends on the extent to which teachers accept and understand the initiative as well as the support they have in implementing it (Ertmer, 2005; Ertmer, Simons, & Simons, 2006; Liu, Wivagg, Geurtz, Lee, & Chang, 2012; Luft, 2001; Pecore, 2012; Pedersen & Liu, 2003; Savasci & Berlin, 2012). Though not easily transformed, teachers' perceptions and beliefs are predictors of instructional change and can be shifted through increased opportunities for reflection, application of new knowledge, and protection from adverse consequences for failure

(Erickson, 2007; Olsen & Kirtman, 2002; Opfer & Pedder, 2011; Pajares, 1992; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Rowan & Miller, 2007).

Conversely, while teachers' beliefs influence their decision-making, beliefs are also revealed through their practices and by what they express during interviews (Aguirre & Speer, 2000; Kynigos & Argyris, 2004; Pajares, 1992). Moreover, teaching and learning in schools is influenced by social systems that define how organizations function. In 2012, PISD joined the SBSDN, a network of public school districts that use the Schlechty Center's System Capacity Standards to assess organizational capacity to support change. This work includes analysis of a school district's social systems, the set of relationships between and among rules and roles that define behavior within organizations, and how these systems either support or inhibit innovation (Schlechty, 2009). Social systems, defined in Table 1, are expressions of the organization's cultural context and include the "set of beliefs, values, and shared commitments" that provide the context in which work occurs (Schlechty, 2009). Innovation is often incompatible with the existing cultural context and requires "accommodating changes in one or more of the systems that define the way work is done in the organization," particularly the directional system and the knowledge development and transmission system (Schlechty, 2011).

Table 1

Six Critical Social Systems for Educational Innovation

Social System	Description
Directional	The systems through which goals are set, priorities are determined, and when things go awry, corrective actions are initiated.
Knowledge Development and Transmission	The formal and informal systems that define the means by which knowledge related to the moral, aesthetic, and technical norms that shape behavior in schools and school districts is developed, imported, evaluated, and transmitted.
Recruitment and Induction	The systems through which new members are identified and attracted to the organization and brought to understand and embrace the norms and values they must understand and embrace to be full members of the organization.
Boundary	The systems that define who and what are inside the organization, and are therefore subject to the control of the organization, and who and what are outside the organization, and are therefore beyond the reach of the systems that make up the organization.
Evaluation	The systems through which measures of merit and worth are assigned, status is determined, honor is bestowed, and the method and timing of negative sanctions are set.
Power and Authority	The systems that legitimize the use of sanctions, define the proper exercise of power, and determine status relationships.

Teachers' practices are mediated by the interaction between their beliefs about teaching and learning and the organizational context in which they work (Ernest, 1989; Lacorte, M., & Canabal, E., 2005). Supporting innovation in an organization involves "repositioning and reorienting action" by adopting a "radically different means of doing the work it [the organization] has traditionally done" (Schlechty, 2009). This includes altering the culture in which programs are implemented as well as changing the "system of rules, roles, and relationships within an organization so that needed innovations are supported rather than rejected" (Schlechty, 2009). The implementation of PBL has implications for how power and authority is used, both in the classroom in terms of the roles of teachers and students, but also in how teachers operate within the larger school structure. The implementation of an instructional innovation like PBL requires a renegotiation of the socially distributed power balance among those operating within schools. As a constructivist-based strategy, PBL requires systems that promote students taking ownership of learning and teachers using PBL protocols in ways that support constructivist principles. The protocols that characterize PBL only represent objective indicators of PBL implementation and do not account for the teachers' experience in understanding PBL or in implementing it in a standards-based environment. System design, including those that influence teacher professional development, should focus on how teachers might transform their perspectives on teaching and learning so as to align the implementation of PBL protocols with constructivist principles so that PBL truly represents instructional innovation (Pecore, 2009).

Input from Others Informing the Solution

Collaborative school investigation. In the fall of 2012, PISD conducted a two-day collaborative school investigation to consider its capacity to support innovation. Teachers, administrators, school board members, and community members used the Schlechty Center's System Capacity Standards for guidance. The purpose was to identify high-leverage actions the school district could take to support and promote instructional innovation and to understand why initiatives succeed or fail. Among the findings of the investigation were that the school district was well situated in some ways to support instructional innovation (technology infrastructure, time built into schedules for teacher collaboration) but also needed to enhance its understanding of how teachers work within the district's support systems to be instructionally innovative. Also, the investigation revealed a need for the district to implement processes for maintaining its direction. These included developing a focus on the quality of work provided to students, developing processes for teacher reflection, developing structures for making decisions, and developing structures for continuity.

Leadership academy. The leadership academy includes a district-level design team comprised of teachers and administrators. The leadership academy conducted three, two-day sessions to consider the future of the school district using the Schlechty Center's System Capacity Standards and its framework for understanding student engagement. Summary reports produced from these sessions indicated that there are a lack of non-traditional learning environments and that there is little student voice and choice in learning activities across the district. The summary also showed that

administrators had little understanding of how to facilitate more inquiry-based learning and to what extent their teachers shared their views about inquiry-based learning.

Working on the work. Teachers and administrators participated in two, two-day sessions of designing work for students using the instructional design qualities outlined by the Schlechty Center. Teachers and principals studied ways to connect the curriculum to experiences that appeal to the various needs and interests of students. Participants created instructional design specification sheets using the design qualities that align with typical PBL protocols. In designing lessons, the majority of teacher participants incorporated a product-focus into the work they planned for students, activities that would require students to collaborate with one another, and student choice in how learning would be demonstrated.

PBL campus observations. On two occasions, teachers and administrators visited campuses in other districts using PBL in their instructional programs. The visits were to campuses at various stages of PBL implementation and included observing PBL at the elementary, junior high, and high school levels. The visits were designed to expose teachers to PBL and to provide teachers with opportunities to interact with teachers, students, and administrators using PBL. Also, the visits gave teachers an opportunity to reflect upon their own understanding of PBL.

Secondary campus observations. An independent constructivist learning specialist and PBL instructional coach spent two days observing the district's high school and junior high school learning environments. The specialist made observations and recommendations regarding the learning environment, curriculum, assessment, and

instruction. The summary reports indicated that leadership and student disposition were conducive to implementing a constructivist approach to teaching and learning but that current instruction and assessment practices indicated that inquiry learning was not occurring. The reports also showed that the vast majority of teachers either did not hold constructivist teaching beliefs or did not know how to incorporate constructivist strategies into their instructional designs. The reports indicated that the default philosophy on both campuses appeared to be “teaching equals telling” and that lecture was the predominant pedagogical strategy and note-taking the predominant student activity (Haltom, 2013).

CHAPTER II

PROPOSED SOLUTION AND METHODS

Proposed Solution

Instructional innovations, like the implementation of PBL, are influenced by the social systems that guide the school, the extent to which teachers understand and accept the principles underlying the innovation, and the perspectives and practices of teachers. The purpose of this record of study was to document how a group of teachers implemented a PBL instructional initiative, identify the extent to which teachers' beliefs aligned with their practices, and learn how the organization's social systems impacted the implementation. To document the teachers' perspective and techniques, I proposed to interview teachers between the time they received their initial PBL training and the end of the first grading period during which implementation began. I proposed to use a constructivist learning environment observation protocol to observe the classroom environments. Finally, I proposed to ask PBL teachers to complete a constructivist learning environment survey to provide insight about how their practices align with constructivist principles of teaching and learning.

The research questions that guided this study were:

1. What practices do teachers use to implement project-based learning into their learning environments?
2. How do teachers instructional practices align with their beliefs regarding constructivist principles?

3. What are the systemic factors teachers consider important in affecting their ability to implement project-based learning protocols in their learning environments?

Methods

This record of study employed a case study approach. Case studies involve contextual analysis of a program or entity within an authentic, bounded setting to explain a situation or describe a phenomenon and provide insight for developing solutions to problems (Yin, 2009). This study focused on four junior high school teachers who implemented a PBL instructional model in their classrooms. The participants received training in PBL during the summer prior to implementation and coaching in the model during the data collection period. Participants included two English language arts teachers and two mathematics teachers. The study was bounded by the first nine-week grading period of the school year in which the PBL model was implemented.

Participants. Four teachers implementing PBL were chosen using purposeful sampling (Creswell, 2012). The participants all received PBL training through a partnership with an outside agency in the summer prior to implementation and additional coaching after the school year began. Two English teachers and two math teachers participated in the study. One of the teachers had more than 20 years of teaching experience, two had between 5-10 years of experience, and one was in her second year of teaching.

Data collection and analysis. To enhance reliability and validity while providing for a rich description of the participants' experiences implementing PBL, data collection included interviews, classroom observations, and a questionnaire. Also, the

researcher kept a reflexive journal to inform data analysis. Reliability and validity are important for judging the quality of a record of study. The quality of a study should be judged by the terms of the paradigm within which it is carried out (Healy and Perry, 2000). In qualitative paradigms, reliability and validity are closely associated with credibility, consistency, dependability, and applicability (Lincoln & Guba, 1985). Triangulation strengthens these elements through the use of multiple data sources. Furthermore, case studies depend on multiple forms of data collection to facilitate detailed description and the recognition of themes or issues that inform the overall meaning of a phenomenon (Creswell, 2012).

An issue in a qualitative study with respect to triangulation is how to handle conflicting evidence and how to determine the relative weight of importance among the various sources of data. The role of the researcher in a qualitative study can inform how both of these quality issues are addressed through the use of reflexive practices. Reflexive practices account for how the researcher impacts the study and, therefore, how readers receive the final narrative (Johnstone, 2007). Researchers should acknowledge their position in the study context in their writing (Creswell, 2012). In addition to providing a chain of evidence for readers by keeping a case study record in which all data were preserved, the researcher kept a reflexive journal (see Appendix D).

Classroom observations. The researcher observed participants' classrooms using a constructivist classroom observation form (CCOF). The form allowed the researcher to keep records of classroom culture, teaching practices, learning activities, and learning

experiences with respect to constructivist learning principles (Cassady, Neumeister, Adams, et al., 2004; Pecore, 2009).

Classroom culture. Alignment to constructivist learning principles was analyzed using a five-point scale for each 10-minute interval, with the observer recording the degree (not evident, somewhat evident, evident, represented, well-represented) to which the classroom environment incorporated principles associated with constructivist learning.

As shown in Table 2, the constructivist behaviors observed included personal relevance (PR), critical voice (CV), shared control (SC), student negotiation (SN), and student attitude (SA).

Each teacher was observed nine times during the data collection period. Alignment with constructivist principles was calculated using the average daily recorded value of each learning principle.

Table 2

Constructivist Principles Measured by CCOF and CLEQ

Constructivist Principle	Description
Personal Relevance (PR)	Extent to which teachers related learning experiences to real-world, student-world experiences
Critical Voice (CV)	Extent to which students are comfortable questioning or directing instructional plans and methods
Shared Control (SC)	Extent to which students share control of the learning environment including the design and management of their learning activities
Student Negotiation (SN)	Extent to which students explain and justify to other students their ideas, reflections, and learning
Student Attitude (SA)	Extent to which students appear to value the learning activities and the impact of activities on student engagement

As shown in Table 3, results indicated one of the following with respect to each constructivist principal measured: high agreement, high intermediate agreement, low intermediate agreement, or low agreement. The values were multiplied by the number of questions on the Constructivist Learning Environment Questionnaire (CLEQ) that were intended to inform teacher perspectives on the presence of each constructivist learning principle in their classrooms. This provided a basis for comparing what was recorded on the CCOF with teachers' perspectives from the CLEQ.

Teaching practices. The CCOF was also used to record the teaching practices being used in the classroom. There were 19 potential teaching practices that could be observed in the classroom. Codes were recorded for each 10-minute interval during classroom observations to document teacher instructional practices. It was possible that multiple instructional practices could be observed during each 10-minute interval. Instructional practices included both teacher and student actions.

Table 3

Constructivist Principle Scoring Scale

Personal Relevance Scale (8-40)	8-15.9	low agreement
	16-23.9	low intermediate agreement
	24-31.9	high intermediate agreement
	32-40	high agreement
Critical Voice Scale (7-35)	7-13.9	low agreement
	14-20.9	low intermediate agreement
	21-27.9	high intermediate agreement
	28-35	high agreement
Shared Control Scale (6-30)	6-11.9	low agreement
	12-17.9	low intermediate agreement
	18-23.9	high intermediate agreement
	24-30	high agreement
Student Negotiation Scale (7-35)	7-13.9	low agreement
	14-20.9	low intermediate agreement
	21-27.9	high intermediate agreement
	28-35	high agreement
Student Attitude Scale (7-35)	7-13.9	low agreement
	14-20.9	low intermediate agreement
	21-27.9	high intermediate agreement
	28-35	high agreement

As shown in Table 4, practices included a variety of teacher and student activities. The data was aggregated to determine frequency with respect to the various practices, both for each participant and for the group overall.

Questionnaire. The Constructivist Learning Environment Questionnaire (CLEQ) was used to identify teacher perspectives regarding the presence of constructivist learning principles in their learning environments (Anigun & Anilan, 2013; Beck, Czerniak, & Lumpe, 2000; Cannon, 1995; Haney & McArthur, 2002; Johnson & McClure, 2004; Taylor, Fraser, & White, 1994). There were 35 questions. The questionnaire was scored on a five-point Likert scale designed, for purposes of comparison, to measure the same constructivist learning principle categories used on the CCOF: personal relevance, critical voice, shared control, student negotiation, and student attitude. Results indicated one of the following with respect to each constructivist principal measured: high agreement, high intermediate agreement, low intermediate agreement, or low agreement.

Table 4

Teaching Practices Observed Using CCOF

Instructional Activity	Code	Description
Teacher reads problem	TP	Teacher reads problem to group of students
Students read the problem	SP	Students read the problem in small groups
Student groups	GD	Students in small groups discuss facts, needs-to-know, action plan, and ideas/solutions
Teacher interacting with individual student	TIS	Teacher working with/talking to/helping individual student
Teacher interacting with small group	TIG	Teacher working with/talking to/helping small group of students
Technology use – students	TS	Technology being used by students for related learning activities
Other resources use – students	NTS	Other resources provided by teacher for related learning activities
Student presentation	SP	Student(s) presenting information to the class (either planned or on-demand)
Demonstration by teacher	D	Teaching demonstrating a procedure to the class
Questioning by teacher	Q	Teachers asking questions of student(s) in a group setting
Student responding	SR	Student(s) answering questions posed by teacher (choral response included in this category)
Manipulative	M	Student(s) working with concrete materials to illustrate abstract concepts
Seat work – individual	SWI	Student(s) working at desk on academic materials (independently)
Seat work – group based	SWG	Student(s) working at desk on academic materials (groups)
Cooperative learning	CL	Students working in a planned cooperative structure to complete a task
Technology use – teacher	TT	Technology being used by the teacher for presenting instructional content
Assessment activity	A	Students engaged in a formalized assessment activity (e.g., test; performance)
Teacher directed discussion	TDD	Teacher facilitates a whole class discussion
Teacher lecture	TL	Teacher provides lecture/students take notes
Other	O	List other activities

Questionnaire. The Constructivist Learning Environment Questionnaire (CLEQ) was used to identify teacher perspectives regarding the presence of constructivist learning principles in their learning environments (Anigun & Anilan, 2013; Beck, Czerniak, & Lumpe, 2000; Cannon, 1995; Haney & McArthur, 2002; Johnson & McClure, 2004; Taylor, Fraser, & White, 1994). There were 35 questions. The questionnaire was scored on a five-point Likert scale designed, for purposes of comparison, to measure the same constructivist learning principle categories used on the CCOF: personal relevance, critical voice, shared control, student negotiation, and student attitude. Results indicated one of the following with respect to each constructivist principal measured: high agreement, high intermediate agreement, low intermediate agreement, or low agreement.

Interviews. A semi-structured interview was conducted with each participant near the end of the data collection period. Interviews were audio-recorded and transcribed. The data was analyzed using the constant comparison method (Creswell, 2012). Constant comparison involved breaking down the data into discrete segments and coding it to categories (Lincoln & Guba, 1985). Words provide a means for people to understand their own circumstances and to convey experience. Constant comparison provided a framework for finding “patterns within those words and to present those patterns for others to inspect while at the same time staying as close to the construction of the world as the participants originally experienced it” (Maykut & Morehouse 1994). Categories were refined as segments were analyzed and the relationship among the categories evolved. Categories arising from this method included those identified by the

researcher to be significant for developing understanding of the social processes involved and those derived from the participants' language to conceptualize their experiences and views (Lincoln & Guba, 1985).

Reflexive journal. A reflexive journal allowed the researcher to acknowledge "preconceptions about the research phenomena arising from personal background and theoretical paradigms" (Johnstone, 2007). The reflexive journal helped to inform my own biases and includes details regarding my own beliefs about the research phenomena, the circumstances under which data was collected, and information about my own motivations, insights, and understanding as the study progressed.

CHAPTER III

RESULTS

The analysis identified what practices teachers use to implement PBL into their learning environments, how their beliefs align with those practices, and systemic factors teachers consider important for the implementation of PBL. The most frequently used practices were: students working in a planned cooperative structure; teachers interacting with small groups of students; students in small groups discussing facts, ideas, and solutions; and students using the Web for research. Second, teachers indicated that they believed their practices aligned with constructivist principles overall while observations indicated teachers' practices reflected low-intermediate agreement with constructivist principles overall. Finally, the data analysis revealed teachers considered the principal a central figure for driving the implementation of PBL as both a source of pressure for moving to the PBL model and a source of information, making power and authority the feature motivation for implementation of PBL. The analysis also found that teachers found the school's student-centered instructional mission to be an important influence, although it was mediated by their beliefs regarding the students' participation in the PBL environment. Also, teachers considered the training and support from the outside agency with which the school partnered to implement PBL to be influential in their implementation along with informal relationships among teachers. A within-case narrative of each teacher's experience is presented first followed by a cross-case narrative.

Within-Case Analysis

The within-case narratives summarize each teacher's experience based on the semi-structure interviews, CLEQ results, and classroom observations. Participants were given a pseudonym for reporting the results.

Sara. Sara was in her second year teaching but came to the profession as a result of a career change rather than right out of college. She has two children, one in college and one in junior high school, and indicated that their experiences in school have shaped her views as a new teacher. She described her instructional approach as student-centered, indicating this was influenced by her own views as well as those of the campus when she arrived. Sara had been among a group of teachers on the campus who visited other campuses to observe PBL environments during the previous year. Sara was highly reflective in her practice, an avid learner, and could be very self-critical. Sara implemented the PBL protocols she learned in the training and was open to the subsequent coaching provided by the trainers during the first semester. She worked in a department that designed projects together. Two of the teachers in this department were formally trained and two of them were not, so Sara's learning process also involved helping other teachers to understand the protocols.

Sara's biggest concern regarding PBL was that students would not master the state standards as measured by the state assessment. Her concern was that the learning curve for herself and for her students associated with using a PBL process for the first time inhibited adequate learning of the standards. Sara was most concerned about the

time intensive nature of designing projects and the appropriate integration of the standards into those designs.

Sara said the creative, non-linear nature of project design required large amounts of time as “the design phase is the most important because if you poorly design something, it’s almost impossible to facilitate.” Sara cited having an “inside and out knowledge of the standards” as most critical in good project design followed by having the time to collaborate and design with other teachers. Sara described herself in the PBL model as a facilitator. She said,

I guide students learning. I do not explicitly teach students except through small groups. And then I cruise a lot to make sure everyone is on task and making sure everyone is working on what they're supposed to be working on, but the facilitator's role is exactly what it says, you facilitate their learning experience, and you make sure the students are owning their own learning instead of me feeling like I own it as their teacher. They have to own it themselves.

For students, Sara’s concern regarding mastery of the standards was connected to students’ ability to regulate their own learning and the amount of time students have to work on higher level instructional activities. Sara found it difficult to facilitate students’ full engagement in things like problem analysis, research, reflection, and peer coaching in a typical class period. These processes required student collaboration, particularly the turn-around process, as Sara was implementing it, which involved students getting direct instruction from the teacher in small-group workshops that they then shared with their respective groups. Sara noted that “with a 50-minute schedule, once (students) get deep into everything, they don’t have time to go back and share what they learned with their teams” and that she often “crosses her fingers that (students) remember what they

learned” from one day to the next. While Sara’s description of the workshop process revealed a misconception about how workshops should ideally work in a PBL environment, her observations represented significant concerns about the likelihood of her students mastering the intended standards.

Sara’s self-reported CLEQ mean score of 26.8 indicated she perceived her teaching to have high intermediate alignment with constructivist principles overall. Sara’s highest self-reported score was in critical voice followed by student negotiation. Her lowest self-reported score was in student attitude. Observations of Sara’s classroom also indicated high intermediate agreement with constructivist principles overall, although her self-reported score was at the high end of the high-intermediate range and her observed score was at the low end. As noted in Table 5, the largest discrepancy was in critical voice, or the extent to which students are comfortable questioning or directing instructional plans and methods. Classroom observations indicated that Sara shared some decision-making responsibilities with students on a regular basis but also that there was low agreement in critical voice. Students were most often seen to be directing learning when the work was associated with simple tasks but less so when it was about deciding how they would demonstrate learning. Observations of Sara’s class and the semi-structured interview with Sara inform this discrepancy. An example was Sara’s application of the PBL workshop protocol. Theoretically, students ought to be directing the planning of workshops by identifying what they need to know, requesting workshops, and being allowed to attend workshops based on their personal needs. Sara’s use of the protocol is teacher-directed. Sara identifies most workshops and only

allows one individual from each group to attend a workshop. That student then takes the information back and teaches it to the rest of the group. While this practice reflects low agreement with critical voice, it also has implications for one of Sara's primary concerns: student mastery of the standards. There is often two degrees of separation between the content expert and students regarding information that is new to students and, thus, critical for building the knowledge that leads to mastery of the standards. Further explaining Sara's perceived agreement with critical voice and what was observed was Sara's frustration with students' ability to self-regulate their learning. Sara had anxiety about not knowing how students were spending their time while she was doing things like holding direct instruction workshops for small groups of students or interacting with project teams and individuals. She said,

...it hasn't clicked for all of the students yet that they own their own learning; that they are in the driver's seat, that they are responsible for directing their own path to success in my classroom. It hasn't clicked, so it's recess I feel like they feel like. I can't be in two places at one time. I can't teleport. Unfortunately, I haven't figured that one out yet.

Table 5

Observer and Sara Scores and Agreement Levels

Constructivist Principle	Obs. Score	Obs. Rated Agreement Level	Tchr. Score	Teacher Rated Agreement Level
Student Attitude	26	high intermediate agreement	21	high intermediate agreement
Shared Control	22	high intermediate agreement	19	high intermediate agreement
Student Negotiation	21.9	high intermediate agreement	29	high agreement
Personal Relevance	22.2	low intermediate agreement	32	high agreement
Critical Voice	13.5	low agreement	33	high agreement
Total Agreement	21.1	high intermediate agreement	26.8	high intermediate agreement

Note. Score ranges to determine agreement level include: personal relevance (low agreement = 8-15.9, low intermediate agreement = 16-23.9, high intermediate agreement = 24-31.9, high agreement = 32-40); critical voice (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); shared control (low agreement = 6-11.9, low intermediate agreement = 12-17.9, high intermediate agreement = 18-23.9, high agreement = 24-30); student negotiation (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); student attitude (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); Overall (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35).

After critical voice, the next largest area of discrepancy between Sara's perceived agreement and observed agreement was in personal relevance. Personal relevance involved the extent to which teachers related learning experiences to real-world, student-world experiences. Sara experienced higher student engagement and increased student learning in her classroom, during the year prior to implementing PBL, when she planned activities that she perceived were student centered and appealed to student interest. She said,

I saw with my own two eyes the different levels of engagement based on what I thought was supposed to happen in the classroom and what was really happening whenever the activities were student centered. When things were hands-on, they learned more than me standing and giving explicit instruction from the front of the classroom.

During PBL implementation, Sara attempted to make work personally relevant to students by seeking to connect standards-based work to issues outside the school environment. Theoretically, the choice of how to demonstrate learning should be left to students unless a specific product is required by the real-world audience. Otherwise, as in a traditional setting, the work is being done for the teacher rather than for an authentic audience or to account for student interest. In Sara's projects, the final products were usually chosen by Sara. Sara remarked that students "don't realize that they have choice" and that "they're not owning their own learning because they haven't taken the initiative yet to own their own learning." One issue to consider is my own experience as a teacher and how that has influenced my views on the implementation of PBL. While I was not trained in the use of PBL protocols while I was teaching, my approach incorporated its common elements including a focus on real-world issues, an emphasis

on student inquiry and collaboration, an allowance for student choice, and a focus on student products. My use of these ideas developed from the content rather than a pre-conceived learning philosophy. Technology and media applications are perhaps more intrinsically motivating content areas than math and English/language arts. My belief in the PBL approach comes from my teaching experience and certainly influences how I perceive teachers' attempts to make work relevant to students and provide them choice.

Further informing personal relevance is the extent to which students' personal learning needs are accommodated in the learning process. As noted in Table 6, there was little observed interaction with individual students in Sarah's classroom. There was also little assessment observed, and when it was observed, it tended to be whole group assessments given at pre-determined times. While these types of progress checks are important, PBL lends itself to more individual formative assessment. Also, among the least observed practices in Sara's classroom was teacher demonstration. Sara's expressed concern regarding students' ability to regulate their own learning, along with little demonstration of SRL strategies, could indicate she either did not recognize this type of modeling was necessary, wasn't confident modeling SRL, or that she believed self-motivation was an inherent personal quality rather than a learned and supported behavior. Sara's expressed belief in student-centered learning, along with frequently observed practices of cooperative learning, student use of technology, and commitment to the grouping design associated with the PBL model, suggested that the little teacher demonstration and individual assessment observed in her class could have been related

to the large learning curve associated with implementing PBL as opposed to a belief in fixed student characteristics regarding motivation to learn.

Finally, observations of Sara's class indicated moderate to high levels of engagement. The observation protocol defines engagement as the percentage of students that appear to be engaged in learning at any given time during a class; an observable construct. The construct of student engagement is an important one because the district's core beliefs about student learning depend on a common understanding of student engagement that is different than the one used by the observation protocol in this study. The district's definition of engagement is that students are said to be engaged if and when they find meaning and purpose in the work they do at school. This is not an observable construct. Engagement, by this definition, can only be understood by knowing and talking to students about their experiences in school over time. For Sara's classes, engagement level was observed to be 78% on average using the study protocol.

Table 6

Learning Activities/Practices Observed in Sara's Classes

Learning Activities/Practices	Instances Observed
CL - cooperative learning	31
TIG - teacher interacting with small group	28
TS - technology use students	24
GD - student groups	18
TDD - teacher directed discussion	6
A - assessment activity	6
TIS - teacher interacting with individual student	5
SWI - seat work individual	4
SR - student answering questions by teacher	3
SP - student presentation	3
D - demonstration by teacher	3
TL - teacher lecture	3
TT - technology use teacher	2
O - other	1
Q - questioning by teacher	1
TP - teacher reads problem	1

This aligns with the high intermediate agreement observed in student attitude. While student attitude received the highest observer rating in terms of agreement with constructivist learning principles, it was the area in which Sara rated herself the lowest on the CLEQ. Sara's indication, noted previously, that she saw different levels of engagement depending on how work was designed for students reveals that the engagement construct she understood is more observable, like the one used in this study, than representative of the district's core beliefs. This, along with the large learning curve associated with implementing PBL, helps to explain the lower relative observer ratings for critical voice and personal relevance.

Lisa. Lisa was in her seventh year teaching. Lisa had been among the group of teachers on the campus that visited other campuses to observe PBL during the year prior to her implementation. She said she had been excited about what she observed and had experimented in the latter part of last year with PBL in her classes. Lisa seemed to feel pressure regarding PBL implementation, suggesting that implementation was happening too fast and that it had been the decision of the principal to push the teachers in this direction. She indicated that she would like to have taken more time and implemented the protocols in steps rather than “flying the plane as you build it, which is what we’re kind of doing here.” Lisa was not sure she was being successful, suggesting that she can see “parts of it being successful and parts of it failing miserably.” She said:

I feel like you can't build a house without building a foundation first, and I feel like we didn't build that foundation first, you know with soft skills and things like that. It was just, here's the entire house, let's kind of make sure all the parts are up. It's kind of like feeding a dog new food. You don't just throw all the food at the dog or else it will just get sick. You kind of, OK, now you have a

quarter of your new food and three quarters of the old, and you kind of implement it that way.

Lisa associated her difficulties implementing the model with students' lack of SRL skills. In suggesting that PBL implementation take place in steps, she indicated she would have liked to do one project in the first nine weeks that perhaps introduced soft skills (skills related to working with other people) to students followed by one more project in the second grading period that introduced research strategies. It's worth mentioning that the decision to implement PBL fully was the principal's decision, but was something that he and I discussed. The rationale for characterizing implementation as full rather than partial was both conceptual and practical. First, PBL is not about projects but shifting a burden for analyzing learning and mastering standards to students. It was decided that partial implementation would be confusing to students. Second, PBL implementation represents a major shift in teacher perspective and, thus, only full implementation would likely focus teachers consistently on those aspects of instruction necessary to facilitate the shift. I did not discuss this directly with Lisa.

Students were moderately engaged in the learning activities overall during the observation period, meaning 41-60% of students could be observed to be on-task on average. Lisa's personal impression of student engagement was similar. Although she rated herself to have high intermediate agreement in student attitude, it was the area in which she rated herself the lowest. She also stated that off-task behavior was greater in her classes than in any other year she taught. She said:

It's kind of like letting prisoners out of prison. They're like, what do we do with ourselves? OK, we'll just go nuts, but they don't have that self discipline to come back and buckle down, so that's been one of the biggest challenges.

Lisa's self reported CLEQ mean score of 26 indicated she perceived her teaching to have high intermediate agreement with constructivist learning principles overall. As shown in Table 7, Lisa's CCOF mean score of 16.9 showed low intermediate agreement overall. Critical voice, shared control, and personal relevance were the areas of lowest agreement. Lisa indicated that she maintained control over the development of learning activities, and this was confirmed by observations of Lisa's classes. Student choice in the direction of learning was in deciding "what order (the activities) are done, because I'll say here's what needs to be done by this period, and they decide what to do when. So they have choice in that way." It was in critical voice, or the extent to which students are comfortable directing instructional activities, that Lisa's observed rating was the lowest.

Table 7

Observer and Lisa Scores and Agreement Levels

Constructivist Principle	Obs. Score	Obs. Rated Agreement Level	Tchr. Score	Teacher Rated Agreement Level
Student Attitude	22.1	high intermediate agreement	22	high intermediate agreement
Shared Control	17.5	high intermediate agreement	20	high intermediate agreement
Student Negotiation	15.1	high intermediate agreement	34	high agreement
Personal Relevance	18	low intermediate agreement	30	high agreement
Critical Voice	12	low agreement	24	high agreement
Total Agreement	16.9	low intermediate agreement	26	high intermediate agreement

Note. Score ranges to determine agreement level include: personal relevance (low agreement = 8-15.9, low intermediate agreement = 16-23.9, high intermediate agreement = 24-31.9, high agreement = 32-40); critical voice (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); shared control (low agreement = 6-11.9, low intermediate agreement = 12-17.9, high intermediate agreement = 18-23.9, high agreement = 24-30); student negotiation (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); student attitude (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); Overall (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35).

Perhaps associated with students' SRL abilities was Lisa's concern about her role in a PBL classroom. Lisa said she was not sure what her role was and that she found it difficult to determine when to provide assistance and when to step back. She said:

Before I kind of knew how much help to give, and now, with PBL, it's kind of like, what do I do? When do I let them kind of falter and find their way, and when do I step in?

The notion that one steps in and out is somewhat concerning regarding the facilitation of a PBL environment. As noted in Table 8, while students were observed to be working in group settings, teacher interaction with small groups was not observed frequently. Also there was more individual assigned seatwork in Lisa's class compared to the other participants. Lisa was not the only teacher to feel uneasy about facilitating learning in the PBL environment. Assessment practices were not observed at all in her class, suggesting that perhaps her uncertainty about her role had something to do with not understanding where students were in their learning of the content standards. Lisa indicated that when students take initiative with a learning task, they learn it better in the PBL model than before. She said she gives intermittent progress checks, and although these were not observed, this lends some support to the idea that she does not facilitate enough assessment, particularly formative assessment, in her teaching. She said:

I feel like when they actually do take the initiative to learn something, they know it better because I had a progress check, and I was asking them what is this and what is that, and they could tell me better than when we used to do vocabulary. It was amazing that they could tell me that when they take that initiative, but the problem is them taking that initiative without me sitting over them.

Table 8

Learning Activities/Practices Observed in Lisa's Classes

Learning Activities/Practices	Instances Observed
GD - student groups	22
TS - technology use students	22
CL - cooperative learning	20
SWI - seat work individual	17
TIG - teacher interacting with small group	9
NTS – use of other resources provided by teacher	8
TIS - teacher interacting with individual student	6
TDD - teacher directed discussion	5
D – demonstration by teacher	3
SWG – students working at desk on academic materials in groups	3
TT – technology use by teacher	3
SR – students answering questions posed by teachers	2
O - other	1

Finally, Lisa felt like she was alone in implementing the model. She was working without a design partner. The other teacher in her content area was not implementing PBL. She felt like this was a hindrance given the time-intensive nature of PBL design.

Jill. Jill was in her third year teaching, but it was her first year teaching in her current content area. Jill had experimented with PBL on her own in the year prior to implementation and was committed to the campus' vision for student-centered learning. Jill had a very positive outlook about PBL. Implementation of the protocols, on a process level, was evident in her classes from the beginning. However, Jill also exerted more control over the process than Sara or Hope, partly because she was teaching younger students and partly because of the impression she had of her students' learning needs. Classes began each day with an independent reading, note-taking activity. This was very teacher directed. While students were in teams, Jill would address the class as a whole, mostly to correct behavior and remind students to stay on task. Jill directed collaborative groups through the protocols as the students learned how PBL worked. Jill seemed fully aware of this and very intentional about this control. As noted in Table 9, Jill's lowest self-rating on the CLEQ was in shared-control, and her self-assessment was aligned with the observed rating in shared control. Jill felt like students needed "structure and routine" and transitioned students into the class each day with a whole group activity designed to focus students.

Table 9

Observer and Jill Scores and Agreement Levels

Constructivist Principle	Obs. Score	Observer Rated Agreement Level	Tchr. Score	Teacher Rated Agreement Level
Student Attitude	22.1	high intermediate agreement	28	high intermediate agreement
Shared Control	18.7	high intermediate agreement	19	high intermediate agreement
Student Negotiation	19	high intermediate agreement	27	high agreement
Personal Relevance	20.6	low intermediate agreement	34	high agreement
Critical Voice	14.2	low agreement	23	high agreement
Total Agreement	18.9	low intermediate agreement	26.2	high intermediate agreement

Note. Score ranges to determine agreement level include: personal relevance (low agreement = 8-15.9, low intermediate agreement = 16-23.9, high intermediate agreement = 24-31.9, high agreement = 32-40); critical voice (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); shared control (low agreement = 6-11.9, low intermediate agreement = 12-17.9, high intermediate agreement = 18-23.9, high agreement = 24-30); student negotiation (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); student attitude (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); Overall (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35).

Jill's stated commitment to PBL was based on her experience with students in her first two years of teaching. She indicated that direct instruction, note-taking, and whole-group assessment was "just not working at all, and I think any teacher in this district would agree." She said:

Coming from the low socioeconomic school district, these kids are not at the level they need to be. Do I think they can get there? Absolutely. We've already seen great improvements in our kids as far as their thinking is starting to change. They're starting to think out of the box and take hold of things and do things that you wouldn't see done if you were just handing them a worksheet or making them take notes.

One implication of Jill's approach was less frequent student use of technology. While student use of Chromebooks for research was evident, as noted in Table 10, it was not among the most frequently observed practices. Students working with print-based academic materials or other materials provided by the teacher were more frequently observed than use of technology.

Table 10

Learning Activities/Practices Observed in Jill's Classes

Learning Activities/Practices	Instances Observed
GD - student groups	26
CL - cooperative learning	22
TIG - teacher interacting with small group	15
SWI - seat work individual	9
O - other	9
TIS - teacher interacting with individual student	6
D – demonstration by teacher	6
NTS – use of other resources provided by teacher	5
TS - technology use students	4
TDD - teacher directed discussion	4
SR - student answering questions by teacher	3
Q - questioning by teacher	2

Jill was the only teacher in her content area that went to PBL training in the summer prior to the school year starting, but she was working alongside a veteran teacher who was also trying to implement the protocols without formal training. While essentially coaching another teacher was initially helpful for Jill in learning the model, the intensive design associated with implementing PBL, while also trying to support her fellow teacher, became increasingly difficult. She said,

This is a hard concept, especially with the kids we have, to grasp and even though it's for the better of our kids, I mean I truly believe that after seeing what I've seen so far project to project, but trying to teach it and trying to get the other teachers on board who didn't go to the cohort is a struggle. It's hard to try to help because I can't be in somebody else's class all the time to help them work through kinks like we got to during the training when we were immersed in the model, there were people to help us through.

Jill had two major concerns regarding implementation. First, Jill found it difficult designing authentic units around the standards. Her process began with trying to find “something real that we can base the project on because it's relating it to the real world that's the hard part to me.” She also feared not appropriately addressing the standards, especially considering she was teaching in her current content area for the first time. For PBL, “you have to know the TEKS well. If you don't, there is no way to know if you are covering them in your project.” Jill explicitly expressed concern about moving at a slow pace with respect to covering the standards and “whether I will get all of the TEKS in they need to know, especially the Readiness TEKS.” Reflecting Jill's concern, anecdotal data from observation notes indicated that PBL protocols were evident but that practices reflecting learning in the standards were not evident in early classroom activities. Also lending support to this concern was the low-intermediate

observer rating in the constructivist learning principle, student negotiation. Defined as the extent to which students explain and justify their learning to other students, student negotiation is the constructivist learning principle most closely associated with mastery of the standards, as student discussion about learning around standards should be observable.

Next, Jill was concerned about the soft skills associated with learning in a PBL model, both as a rationale for implementing PBL and as a prerequisite for student success in the model. Jill felt that not grading soft skills inhibited students' learning in the model, noting that if students "can't learn to work together and they can't learn to respect each other and work through problems as a team, then you can't get anything done with the curriculum." Although she did not formally assess soft skills, Jill was observed demonstrating soft skills for students, particularly those associated with collaboration. One of the practices she noted using was an intervention sheet, which outlined a process for conflict resolution within teams. Jill saw growth in this process during the time of study. She said:

I overheard a table where there was a very opinionated student in the group, and he kept arguing about a certain point they were trying to make, and I heard a girl, who was being very patient, and after he got done, she said 'I understand your point but let me show you where I am coming from for this and this is how I see it', and for a sixth grader, I thought, wow, how grown up and mature is that for a sixth grader to talk to another sixth grader that way? I stopped and I was just, like, wow!

Jill was more confident about student growth in soft skills than in content learning during the time of the study. She attributed student growth in soft skills to improved work habits, including greater and more appropriate "division of work" and

higher levels of “on-task behavior.” Jill’s highest self rating on the CLEQ was in the area of student attitude. This was in contrast to the other teachers in the study who all scored themselves the lowest in this area. Jill rated herself in high agreement in student attitude and her observed rating showed high intermediate agreement, the highest observed rating with respect to overall agreement with constructivist learning principles.

Jill’s self-reported CLEQ score of 26.2 indicated she perceived her teaching to have high intermediate agreement with constructivist learning principles overall. After student attitude, Jill’s high self-rating was in personal relevance, which she reported to be in high agreement in her classroom. Personal relevance, the extent to which teachers related learning experiences to the real-world, was the area in which Jill received the lowest observed rating (low intermediate agreement). Supporting this finding was Jill’s admission during the interview that she struggled with this part of project design.

Hope. Hope had been teaching for 20 years when she began implementing PBL. Hope was the head of her department and, like Sara, among the group of teachers who had observed PBL in other schools during the year previous to her implementation. She embraced the campus’ commitment to a student-centered, instructional approach in the year leading up to implementation and was receptive to PBL training and coaching. She was working to implement the formal PBL protocols with fidelity. Hope had used a flipped instructional approach the year before, attempting to move away from direct instruction during class time to using that time for student practice, exploration, and interaction with the teacher. Hope considered this previous experience to be critical for her implementation of PBL, indicating that “going straight from the teacher being the

center to (a PBL) model is super hard. If you're already not the center of your classroom anymore, and then phase into this model, that is the best thing." Hope's approach has been to implement specific aspects of the PBL model, work to improve in those areas, and then incorporate something else. An example was Hope's recognition that her focus early in the year had been on aspects of instructional design related to content. This included developing ideas for projects, preparing content resources for students, and planning direct instruction workshops. She considered it critical that these elements were prepared prior to the unit beginning because "if you don't have things organized, then I can't be a facilitator because I have to worry about too many other things. So everything has to be in place." Therefore, she had not been using other aspects of her training; for example, strategies related to student assessment. She said:

I was already constantly assessing, but I wasn't always giving feedback to my kids. But when Jill (her coach) came back to us, I realized, now we have the design process down a little bit, now we have the plan and those things are coming together and we're not stressing over those, it's much easier to say, OK, now I need to start using other tools to give feedback consistently to students.

Hope's biggest concern regarding PBL was that students would not get the information she thinks they need to master the standards required by the state. Hope saw progress in the students' participation in the learning protocols during the time of the study, and observations of her classroom indicated high intermediate agreement in both student attitude and shared control. Initially, while Hope did not characterize students as resistant, she said students "did not want to break out of the old ways and take ownership of their own learning. Pushing them outside of that box is frustrating." Once they understood that "I am not going to stop doing this no matter what, they were, like, OK, I

guess we're going to really do this so I better start getting with it." Hope indicated that student engagement had increased as work became more connected to things outside of the classroom and they were "not just doing problems for the sake of doing math problems." She said:

I don't get the question anymore, 'When am I ever going to use this?', and in math, you get that a lot. 'Why do I need this?', because everything that their doing is related back to something that's real.

Hope even indicated that in some areas, students were pushing her to accommodate their individual learning needs by asking that do-it-yourself activities be designed in a variety of ways. When they do not understand, "they will ask for alternative assignments. That didn't happen before when we gave worksheets. Now, even though it's more work, I am going to have six DIYs, and you're going to get to choose."

Hope's self-reported CLEQ mean score of 29.6 indicated she perceived her teaching to have high agreement with constructivist principles overall. Hope's highest self-reported score was in critical voice followed by personal relevance. Her lowest self-reported score was in student attitude. Observations of Hope's classroom indicated low intermediate agreement with constructivist principles overall. As noted in Table 11, the largest discrepancy was in critical voice. Hope shared some decision-making responsibilities with students. However, like in Sara's class, students were most often seen to be directing learning when the work was associated with simple tasks like assigning job responsibilities within their groups or whether to complete do-it-yourself assignments. Students had less control when deciding how they would demonstrate

learning. Hope put parameters on where students acquired information to ensure they were getting the right information, but she also asserted that they had choice regarding how they learned by deciding which workshops to attend or whether to use technology.

There were also significant differences between Hope's perception of personal relevance and student negotiation in her classroom and what was observed. Seemingly at odds with Hope's indication that work was resonating with students' interests, the discrepancy in personal relevance could be attributed to the novelty PBL, as a learning model, presented to students early in the year. As students became more comfortable with the protocols, perhaps the extent to which the work itself resonated with students' interests began diminishing. Hope, along with other teachers, did express in interviews that students' actual interests and teachers' perceptions of students' interests do not always match. Hope identified this as a significant issue for project design.

Table 11

Observer and Hope Scores and Agreement Levels

Constructivist Principle	Obs. Score	Observer Rated Agreement Level	Tchr. Score	Teacher Rated Agreement Level
Student Attitude	25.7	high intermediate agreement	26	high intermediate agreement
Shared Control	20.5	high intermediate agreement	24	high intermediate agreement
Student Negotiation	19	high intermediate agreement	30	high agreement
Personal Relevance	18.7	low intermediate agreement	36	high agreement
Critical Voice	14	low agreement	32	high agreement
Total Agreement	19.6	low intermediate agreement	29.6	high agreement

Note. Score ranges to determine agreement level include: personal relevance (low agreement = 8-15.9, low intermediate agreement = 16-23.9, high intermediate agreement = 24-31.9, high agreement = 32-40); critical voice (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); shared control (low agreement = 6-11.9, low intermediate agreement = 12-17.9, high intermediate agreement = 18-23.9, high agreement = 24-30); student negotiation (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); student attitude (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35); Overall (low agreement = 7-13.9, low intermediate agreement = 14-20.9, high intermediate agreement = 21-27.9, high agreement = 28-35).

Teacher interaction with students in Hope's classroom was most frequently observed as interactions with small groups of students. As noted in Table 12, interaction with small groups, along with cooperative learning activities, were the most frequently observed practices. Hope frequently conducted workshops in which direct instruction with small groups was the pedagogical method. Demonstration, which could be interpreted as direct instruction to the whole group, was never observed. Hope indicated this was really her first leap from the traditional approach and, to date, the biggest reason she would not want to return to a whole-class lecture approach. She said,

I would hate to have to go back. I mean I don't even like talking five minutes to the whole class anymore. I still like doing some direct teaching but it's so much easier with a small group, and any teacher will tell you that, it's much easier to direct teach with a small group than it is with a whole class. If I had to keep a whole class engaged from my lecture, that would not be fun for me at all. I would be exhausted.

Finally, observations of Hope's class indicated moderate to high levels of student engagement which aligns with the observed high intermediate agreement in student attitude. While student attitude received the highest observer rating in terms of agreement with constructivist learning principles, it was the area in which Hope rated herself the lowest on the CLEQ.

Table 12

Learning Activities/Practices Observed in Hope's Classes

Learning Activities/Practices	Instances Observed
TIG - teacher interacting with small group	29
CL - cooperative learning	26
TS - technology use students	26
GD - student groups	21
A - assessment activity	9
TIS - teacher interacting with individual student	8
SP - student presentation	6
SWI - seat work individual	5
TDD - teacher directed discussion	4
NTS – use of other resources provided by teacher	4
SR - student answering questions by teacher	3
TT - technology use teacher	3
Q - questioning by teacher	3
O - other	1

Cross-Case Analysis

The cross-case narrative summarizes the practices teachers use overall implementing PBL, the overall alignment between teachers' practices and their beliefs regarding constructivist principles, and results related to the impact of social systems on the implementation of PBL.

Practices. The CCOF was used to record the learning activities and practices being used by teachers implementing PBL into their learning environments. The most common observed practices included the use of cooperative learning and student groups for managing projects as well as teacher interaction in small group settings and student use of technology. Cooperative learning, students working to complete tasks collectively toward a common academic goal, and student groups are closely related. The practice, student groups, was defined as students in small groups discussing facts, ideas, knows, and needs-to-know. In the PBL model, the difference is subtle, rooted in which protocol students may be working at any given time during a project cycle. Student groups involved interaction among students to process information for individual learning goals or individual mastery of standards while cooperative learning referred to the overall design of work that leads to a final product and upon which accomplishment requires student collaboration. Both the use of students groups and the cooperative design of the project units led to frequent teacher interaction with small groups. However, observations about other practices, along with teacher interviews, help to inform these interactions more fully.

Self regulated learners are successful because they control their learning environment. They exert this control by directing and regulating their own actions toward their learning goals (Palincsar & Brown, 1984). In the PBL model, shifting the burden of ownership to students is facilitated through explicit practices that include frequent, formative assessment and demonstration of soft-skill strategies. As noted in Table 13, assessment and demonstration were not frequently observed practices. Assessment activities, when observed, were mostly whole group summative assessments rather than small-group or individual formative assessments. Also, teacher questioning related to standards mastery, a potential formative assessment technique, was not frequently observed. While teachers were frequently observed to be interacting with small groups, two things are important to note. One, students were placed in or allowed to choose work groups and were physically arranged in these groups, so any interactions with students would be observed to be small-group interactions no matter the substance. Second, teacher-led workshops are a PBL tool for direct instruction that was frequently observed and would, necessarily, be recognized as small-group interactions. Finally, student use of technology was most often student use of Google Chromebooks, which existed in each of the classrooms at a 3-to-1 student-to-computer ratio. All student groups had access to at least one Chromebook at all times. The most common student activity with the Chromebooks was online research.

Table 13

Learning Activities/Practices Observed

Learning Activities/Practices	Instances Observed
CL - cooperative learning	99
TIG - teacher interacting with small group	91
GD - student groups	87
TS - technology use students	76
SWI - seat work individual	35
TIS - teacher interacting with individual student	25
TDD - teacher directed discussion	19
NTS - other resources provided by teacher	17
A - assessment activity	15
O - other	12
SR - student answering questions by teacher	11
SP - student presentation	9
TT - technology use teacher	8
D - demonstration by teacher	7
Q - questioning by teacher	6
TP - teacher reads problem	4
SWG - seat work group-based	3
TL - teacher lecture	3

Beliefs. Participants in this study indicated with high-intermediate to high agreement that they believed their PBL learning environments aligned with constructivist principles. Teachers indicated that their learning environments were in high agreement with constructivist principles for three of the five principles analyzed and in high intermediate agreement with the other two. As shown in Table 14, teachers were most confident that their learning environments reflected student negotiation and personally relevant experiences for students. Classroom observations indicated teachers' learning environments were in low to low-intermediate agreement with three of the five constructivist learning principles: critical voice, personal relevance, and student negotiation. Also, semi-structured interview data yielded a variety of information that informed understanding about teachers' beliefs about how their practices align with constructivist learning principles. The majority of this data showed teachers' beliefs and practices were influenced by their perceptions regarding students' ability to learn in a PBL environment. Concern about students' SRL skills was the predominant factor related to students' abilities.

Table 14

Constructivist Principle Observer and Teacher Agreement Level

Constructivist Principle	Observer Rated Agreement Level	Teacher Rated Agreement Level
Student Attitude	high intermediate agreement	high intermediate agreement
Shared Control	high intermediate agreement	high intermediate agreement
Student Negotiation	low intermediate agreement	high agreement
Personal Relevance	low intermediate agreement	high agreement
Critical Voice	low agreement	high agreement

Critical voice. Critical voice, the scale concerned with students' development as autonomous learners, was the lowest observer scored principle overall and the lowest individually scored for all four teachers. Autonomy implies control by self rather than control by others. While teachers organized content and students in a way that reflected the PBL protocols, they maintained control over aspects of the environment critical for autonomy. Teachers determined most of the activities that took place, how students were grouped, and what resources students use for acquiring information. Autonomy is also one aspect of a larger set of SRL abilities that include meta-cognition; planning, monitoring, and evaluating; and motivation (Paris and Paris 2001). Furthermore, these are closely associated with the soft-skill component of PBL which includes these aspects of SRL along with strong skills in communication and collaboration. There is a SRL, soft skill duality: on the one hand, developing these types of skills is part of the rationale for PBL and, on the other hand, having these types of skills is necessary for learning in PBL. Observations indicated little teacher demonstration, including explicit modeling of SRL strategies, yet teachers also indicated that soft-skills are one of the inhibiting factors for them as teachers in PBL. It should be noted that as the district's chief learning officer, one of my roles is teacher support. I am also going through the PBL training with teachers, and contribute to conversations regarding dilemmas as they arise. One such dilemma has implications for how critical voice is evaluated. Teachers expressed concern regarding the on-task behavior of students, particularly when teachers are conducting workshops. It is during workshops that teachers are involved with the fewest number of students so that students not attending the workshop should be working with

other team members with minimal oversight from a teacher. This created anxiety for the teachers in terms of students learning and remaining diligent in their work. This is why greater scaffolding and more structure are also part of the recommendations made in the literature when moving to this type of environment. During in-semester PBL training and discussion with teachers, my position was to encourage teachers to add structure to their designs to account for these concerns. Initial projects early in the grading period were very loosely structured. I observed some added structure in designs from early projects to later projects in the data collection period, including teacher directed research processes and more direct instruction than might be expected once students begin to develop more sophisticated meta-cognitive strategies.

Personal relevance. There was a conflict between the need to have students master standards and the need to help students develop autonomy in learning. To develop autonomy in learning, students must view mastering standards as something that matters, something personally relevant to them (Schlechty, 2011). Teachers expressed that students had voice in terms of speaking in class, questioning, and working with others, but not necessarily in those aspects of learning that would help students develop autonomy. These were admittedly teacher directed processes. Project design, for instance, was a process that began with analysis of standards or the teacher's concept of what might be compelling to students rather than what students indicated would be compelling. From a constructivist perspective, the learning environment "should not favor technical curriculum interest (e.g., covering the curriculum content) to an extent that accountability for classroom activities is directed largely towards an external

authority” (Taylor, P., Fraser, B., & White, L., 1994). Teachers were understandably concerned about the state standards and even expressed concern about whether a PBL environment could get students prepared for the state assessment. Also, the principal, while viewed as supportive, represented a significant authority outside the classroom to which PBL as a direction was attributed.

Student negotiation. Student negotiation is the scale designed to understand the extent to which students interact with other students for learning purposes. In the PBL model, student-to-student discourse is one source for student learning along with research, teacher-led workshops, and do-it-yourself activities. With respect to practices, robust student negotiation would reflect student presentation, particularly on-demand presentation through which students explain, justify, and reflect on their learning. There was little observed student presentation, and while students worked collaboratively in groups, their discussions tended to revolve around things like planning and distributing tasks as opposed to reflection on their progress relative to mastery of standards.

Systems. The directional system and the knowledge development and transmission system (KDT) are the most critical for supporting creativity and innovation within an organization. The boundary system, the evaluation system, and the power and authority system, while important in any organization, are often used to preserve the current condition and inhibit innovation. The recruitment and induction system makes up the processes an organization uses to bring new people into the work of the organization (Thompson, 2012). Identified categories for analysis included the six social systems that define behavior with organizations. While the boundary system and

evaluation system were identified to be categories for analysis, the participants' interviews yielded no data reflecting these system properties.

Directional system. The directional system includes the mechanisms through which goals and priorities are determined. For this study, analysis was intended to inform understanding about what constituted the directional system, or the mechanisms, through which decisions were made with respect to teachers' implementation of PBL.

There were 14 segments coded to the category, directional system. These segments were identified as either pedagogy-based or role-based. Pedagogy-based segments included references to discussion about the purpose of instruction as a system through which decisions were made with respect to the teachers' decision to use PBL. Role-based segments included references to a person or group of persons as a system through which decisions were made with respect to the teachers' decision to use PBL. Teachers indicated engagement and student-centered instruction, as concepts, were important in driving instructional direction. However, the principal, as a role-based mechanism for decision-making, was most often referenced regarding the decision to use PBL as an instructional model. Sara, who expressed support for PBL, said that student-centered instruction was a focus of campus discussion, and that the faculty was "told through staff meetings that our goal was to be a student-centered campus." Lisa, whose observations showed low intermediate agreement with constructivist learning principles, felt pressure regarding PBL implementation, suggesting that implementation was happening too fast and that it had been the decision of the principal to push the teachers in this direction. Jill, whose was observed to have the highest agreement in student

attitude among the four participants, indicated that direction begins with the principal.

She said,

Everybody kind of takes his lead on what he deems, I guess, important for the campus, and it's not a whatever-he-says-goes kind of thing, because it never really is with him, but more of a 'here's the idea and here's where we want to get to.

Finally, the effectiveness of an organization's directional system is related to the extent to which values and beliefs drive an organization's direction. As noted in the previous discussion about beliefs, teachers' beliefs were most often expressed in relation to students' ability to function or learn in a PBL environment. So while teachers indicated verbally a commitment to student-centered instruction, including PBL, their practices were informed by their views on students' abilities, specifically SRL abilities.

Knowledge development and transmission system. The KDT system includes the means by which moral, aesthetic, and technical knowledge is shared within an organization. It addresses the mechanisms by which people learn about an organization's values, goals, and methods for doing its work (Schlechty, 2009). There were 15 segments coded to the category, knowledge development and transmission system. These segments were identified as inter-organizational, horizontal, or vertical. Inter-organizational segments all referenced PBL training, which was conducted by an outside agency. The teachers' indicated that the training they received was critical to their understanding of PBL and influenced what they believed about it. Jill indicated her experience in PBL training the summer prior to implementation strongly influenced her views on PBL. Jill said,

It was the Corpus Christi trip when they immersed us in the process as far as our groups, names, researching, and the model. That was kind of what I base everything on in terms of the environment and what the kids are doing and what it's supposed to look like.

Horizontal and vertical segments included those referencing intra-organizational KDT. Horizontal segments were coded as either department or campus-wide KDT among teachers and vertical segments were those in which KDT was internal but originated from administration. Almost all of these segments referenced the school principal. The principal's KDT influence was based both in technical implementation of PBL and the values behind the rationale for implementing PBL. Horizontal KDT segments were more informal and included KDT through departmental collaboration in project design and informal social discussion among teachers, including interactions at lunch or in the teachers' lounge. These discussions carry a great deal of weight in influencing teachers' views, and potentially beliefs, about PBL. Participants were working in settings with both teachers who had been trained and teachers who had not, yet were attempting to implement PBL protocols. Jill indicated this factor was an additional burden, and Sara noted that others' views influenced her own. Sara said,

If certain teachers aren't liking life with project-based learning, and you listen to those teachers, then suddenly I feel the same way. It depends on what crowd you put yourself in as to how teachers influence you.

Recruitment and induction system. The recruitment and induction system includes the means by which people are introduced to the direction of the organization, including its values and beliefs. These systems are not only relevant for new employees, but also existing employees when the organization is seeking to move in a new direction.

PBL represents an innovation that is a departure from the traditional pedagogical framework with which existing teachers work.

There were 19 segments coded to the category, recruitment and induction system. These segments were identified as either formal or informal processes for recruitment and induction. Formal segments included data that referenced planned campus meetings during which work was focused on developing student-centered instructional ideas. These segments were further identified as communication events or learning events. All communication events involved information coming from the campus principal. All learning events involved formal training sessions, most of which were regarding the summer PBL training event the participants attended.

Power and authority system. The power and authority system reflects how power is defined and exercised as well as how authority and status are differentiated within an organization. It involves the relative value of disposition and position within the organization. Segments were coded to power and authority if they reflected pressure participants felt with respect to the implementation of PBL. There were 10 units coded to the category, power and authority system. These segments were identified as either position or disposition. Position segments, which made up the majority of power and authority references, were identified as being based on the principal's perspective, the allocation of resources, or the use of the administrative power of evaluation. All of these factors reflected the greater presence of value in position as opposed to disposition as a means for exercising power and authority during the implementation of PBL. Disposition segments included references to the use of instructional values, ideas, and

beliefs as a source of pressure during PBL implementation. Values, ideas, or beliefs segments included references that indicated teachers were influenced by the expression of values, beliefs, or ideas from the principal and other teachers. Interestingly, participants both recognized the positional authority of the principal and that his participation was an expression of instructional values, goals, and beliefs.

CHAPTER IV

CONCLUSIONS AND IMPLICATIONS

PBL could be considered a disruptive innovation within public education in the sense that it does not accord with existing social structures that dominate in most school systems. First, teaching is a cultural activity, meaning it is based in generalized knowledge that resides in the minds of its participants and is “learned through informal participation over long periods of time” (Stigler & Hiebert, 1999). People within a culture share a mental picture, or script, of what the culture is like. Teaching, like other cultural activities, has a cultural script. Scripts are comprised of beliefs and assumptions that coalesce over time and provide stability to the culture but also make it difficult to facilitate change (Stigler & Hiebert, 1999). PBL models don’t neatly fit within the current cultural script of teaching in most schools including Progressive Junior High School as it embarked on PBL implementation.

Second, while PBL, as a reflection of constructivist learning theory, does not represent new thinking, its emergence is connected to the materialization of the information age. Digital learning technologies represent a disruption to the educational establishment because they can provide learners access to areas of non-consumption in education (Christensen, 2008). As an inquiry-based approach to learning, PBL environments can provide experiences that help students access higher levels of learning more difficult to approach in traditional settings and develop skills not included in traditional curricula.

Disruptive innovations typically require fundamental systemic change to be implemented and sustained because they threaten pre-existing systems of practice, or cultures (Christensen, 2008; Schlechty, 2009). While the documentation of teaching practices was important to this study, perhaps most important for sustaining the school's PBL initiative was developing understanding about how the implementation accorded with the social systems that defined the culture within which the implementation occurred. Therefore, a systems' analysis frames and informs teachers' beliefs and practices regarding PBL and the discussion about how the district's social systems impacted the implementation.

Directional System

Continuous innovation is essential to school improvement. To introduce and sustain innovation, schools must be able to establish a future-focus, maintain direction, and plan strategically (Schlechty, 2009). This study revealed analogous processes occurring at the classroom and school levels. These processes have implications for making constructivist practices the driving factor in the classroom and for making purpose the driving factor for instructional innovation in the school.

All of the participants in this study indicated that they believed PBL was in the best interests of students and represented the right direction for teaching and learning. Yet there were significant gaps between what they indicated in the CLEQ and what was observed in practice. The teachers' implemented practices that appeared consistent with constructivist learning environments, including the use of cooperative learning structures, allowing students to use technology, and reducing or eliminating whole class

lecture. However, data indicated teachers' learning environments were in low to low-intermediate agreement with three of the five constructivist learning principles, including critical voice, personal relevance, and student negotiation. Furthermore, the teachers in this study indicated student engagement and student-centered instruction, as concepts, were important in driving instructional direction on the campus. However, the principal, as a role-based mechanism for decision-making, was most often referenced regarding the decision to use PBL as an instructional model. The instructional direction of the campus is still driven more by traditional power and authority than a shared purpose or understanding of the rationale for implementing PBL. From a systems' perspective, the results from this study showed PBL requires a rearrangement of traditional power structures within schools; both between teachers and the traditional administrative power and authority structure and between teachers and students in the classroom.

Strong leadership is required to center the directional system on a shared purpose at Progressive Junior High School. A constructivist approach to leadership that facilitates reciprocal learning processes contributes to interdependence, sustainability, partnership, and flexibility (Lambert, Walker, Zimmerman, et al., 2002). As the most important stakeholders for implementing and sustaining PBL, teachers should be afforded significant involvement in the decision-making process regarding the implementation of PBL (Erickson, 2007; Olsen & Kirtman, 2002; Pajares, 1992). While this represents rewriting existing boundaries, which currently reflect decision-making to be a predominantly administrative function, it would contribute to the development of a shared understanding on the campus of why PBL is important. This would constitute a

step in the direction of making purpose a driving force for instructional decision-making as opposed to power and authority.

The traditional fear, of course, is that allowing teachers seats at the decision-making table might result in wider gaps between what administrators ideally envision for teaching and learning and what actually happens. This, however, could be considered a false pretense, particularly if the campus principal is able to facilitate constructivist reciprocal learning processes that contribute to professional community and social capital and also model the very type of learning that is to occur in classrooms (Hargreaves & Fullan, 2012). For example, all four participants indicated in one way or another that they were overwhelmed by the learning curve required of them to implement PBL. It could be inferred from the collective data, and it was explicitly stated by one of the participants, that teachers would decide to slow down the implementation of PBL if given the opportunity. While this might represent a theoretical problem for administrators who envision a broad student-centered approach to learning that is irreconcilable with a teacher-centered approach, from the teachers' perspective, there is misalignment among beliefs, knowledge, practice, and goals as they work to comply with what is essentially an administrative decision. The administrators' theoretical position does not instantly align with the teachers' practical position, and this must be reconciled if PBL is to succeed. Classroom observations indicated teachers' learning environments were in low to low-intermediate agreement with three of the five constructivist learning principles, including critical voice, personal relevance, and student negotiation. Since teachers' may treat their beliefs as knowledge, allowing

teachers to slow down the implementation process could provide time and opportunity for teachers to develop new knowledge, in this case knowledge associated with PBL implementation, that informs what they believe and, therefore, what they practice (Pajares, 1992).

Next, the district core belief that engagement is the key to learning ought to not only inform instructional decision making for students, but be applied to the workplace for teachers as well. For example, critical voice is a core element of constructivist learning, yet was all but absent in all four participants' learning environments. Self-initiated, rather than externally regulated, behavior is important for developing learner autonomy (Ryan, Connell, & Grolnick, 1992). This is no less true for teachers as school employees. Employee engagement, the "cognitive, emotional, and behavioral energy an employee directs toward positive organizational outcomes" is an individual-level construct (Shuck & Wollard, 2010). All the participants expressed fears related to student learning, most ardently the students' ability to master course standards in the PBL environment as the teachers' were experiencing it, not necessarily as it theoretically should work, but as they were implementing and experiencing it based on their current knowledge and beliefs. People want to feel like their efforts positively impact outcomes. By allowing teachers more participation in determining what implementation looks like, it could be argued that not only is time created for developing new knowledge related to constructivist learning and PBL, but teachers are also afforded critical voice in their own learning, which contributes to their workplace engagement and, hence, the

implementation of PBL (Bakker & Schaufeli, 2008; Cordova & Lepper, 1996; Deci, Koestner, & Ryan, 1999; Kim, Kolb, & Kim, 2012).

Knowledge Development and Transmission System

Shifting the burden for directing the learning process from teachers to students depends on helping students recognize, embrace, and evaluate their own learning needs as well as improve their cooperative, learning-focused interactions with other people. The participants all indicated, and the observation data showed, these are not skills teachers believe students inherently have. Students do not necessarily know how to function in an environment in which individual meta-cognitive, SRL skills and social, collaborative skills are essential. Likewise, in today's highly standardized education environment, in which the curriculum is mandated and pedagogy has been commoditized, teachers do not necessarily know how to operate in this kind of environment either. The data in this study showed that while teachers either recognized or believed their students did not have adequate SRL skills, they did not specifically address these deficits in their teaching.

The KDT system represents the means by which knowledge related to the moral, aesthetic, and technical norms that shape behavior in schools is developed and transmitted. It serves as a mechanism for either innovating or sustaining, depending on how, or even whether, it is intentionally designed. The KDT system is potentially a high-leverage system for building individual and organizational capacity (Thompson, 2012). The KDT system at Progressive Junior High School should serve as a vehicle to leverage support for PBL, and student learning in general, by contributing to the

development of the school's social and human capital. Social capital, the patterns of interactions and relationships among teachers, predicts student achievement. When teachers' interactions are frequent and focused on pedagogy, student achievement improves. This is true above and beyond the effects of human capital (Leana & Pil, 2006). Human capital, or teachers' experience, content knowledge, and pedagogical skills, is also important. However, as an individual construct, human capital has a narrower impact on student achievement and does not contribute to the development of social capital. Social capital, however, has a dual benefit. It both contributes to growth in human capital and has wide-spread effects on student achievement (Hargreaves & Fullan, 2012). This makes a KDT system that promotes the development of social capital a high-leverage system for supporting PBL as an instructional innovation that requires both intense professional learning and collaboration.

Teachers in this study valued the PBL training and coaching they received which came from an outside agency, and they valued the contribution of the principal. However, the training was technical in nature, meaning it was more about acquiring the procedural knowledge necessary to implement PBL. Also, while the participants indicated they valued the principal's contribution, both technical and aesthetic, teachers typically go to other teachers for information or advice about pedagogy rather than the principal, or even a resident curriculum professional (Pil & Leana, 2009). These interactions were more informal and included knowledge development and transmission through departmental collaboration in project design and social discussion among teachers, including interactions at lunch or in the teachers' lounge. While two of the

teachers were distressed about the lack of collaborative opportunities with other teachers in PBL design, the interactions each of them described carried a great deal of weight in influencing their views, and potentially beliefs, about PBL as well as their related knowledge and skills. While much training has been provided to help teachers develop pedagogical skills related to PBL, less attention has been paid to facilitating frequent, formal interactions among teachers. Also, the KDT system should facilitate the development of local knowledge that contributes to teachers' increased capacity for instructional design. Action research, which involves practitioners utilizing applied research methodologies for the purpose of improving practice, could contribute to a system-wide mindset for solving problems related to teaching and learning while facilitating increased teacher efficacy for PBL (Glanz, 2003). It also creates a teacher-driven process that can flatten the decision-making hierarchy on a campus, something that would contribute to making student learning the purpose that drives decision-making.

Limitations

Potential limitations include my own participation in the record of study, both from pragmatic and theoretical perspectives. First, in my role as Chief Learning Officer, I have a vested interest in the success of the PBL initiative. While biased reporting would neither serve the purposes of this study nor the goal of the implementation, this should nonetheless be considered. Reflexive practices account for how the researcher impacts the study and, therefore, how readers receive the final narrative (Johnstone, 2007). Researchers should acknowledge their position in the study context in their

writing (Creswell, 2012). In addition to providing a chain of evidence for readers by keeping a case study record in which all data were preserved, the researcher kept a reflexive journal (see Appendix D). Also, I participated along with teachers in the training that took place during the summer prior to implementation and in the subsequent coaching that took place after the school year began. Both my theoretical understanding of PBL and my comfort with observing teaching and learning within the framework of this study increased during the data collection period. While it's hard to identify to what extent these two things impacted observation scoring, these two things should be considered when analyzing results. Also, the case study methodology necessitated a small-group study which might limit understanding from the survey instrument when considering it exclusively among the data collection methods. Case studies depend on multiple forms of data collection to facilitate detailed description and the recognition of themes that inform the overall meaning of a phenomenon. The survey data should be viewed in the context of all the data that was collected.

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APPENDIX A

CLASSROOM LEARNING ENVIRONMENT QUESTIONNAIRE (CLEQ)

Directions

1. This questionnaire asks you to describe your classroom, as a whole. There are no right or wrong answers. Your opinion and perception of your class during PBL instruction, in general, is what is wanted.

2. On the next few pages you will find 42 sentences. For each sentence, circle one number corresponding to your answer.

For example:

During PBL instruction...	Almost Always	Often	Sometimes	Seldom	Almost Never
	5	4	3	2	1
Students ask each other questions.	5	4	3	2	1

- If you think students almost always ask other students questions, circle the 5.
- If you think students almost never ask other students questions, circle the 1.
- Or you can choose the number 2, 3, or 4 if it seems like a more accurate answer.

3. Teacher Name

Complete the questionnaire. Give a response to every question.

During PBL instruction...	Almost Always	Often	Sometimes	Seldom	Almost Never
1. Students learn about the world outside of school.	5	4	3	2	1
2. It's OK for students to ask the teacher "why do we have to do this?"	5	4	3	2	1
3. Students help the teacher plan what they are going to learn.	5	4	3	2	1
4. Students get the chance to talk to other students about their ideas.	5	4	3	2	1
5. Students display actions that suggest they look forward to the learning activities.	5	4	3	2	1
	Almost Always	Often	Sometimes	Seldom	Almost Never
6. New learning begins with experiences or questions about the world outside of school.	5	4	3	2	1
7. Students are free to question the way they are being taught.	5	4	3	2	1
8. Students help the teacher decide how well their learning is going.	5	4	3	2	1
9. Students talk with other students about how to solve problems.	5	4	3	2	1
10. Students appear interested and engaged in most activities.	5	4	3	2	1
	Almost Always	Often	Sometimes	Seldom	Almost Never

11. Students learn how your content area can be part of their out-of-school life.	5	4	3	2	1
12. It's OK for students to voice concerns about activities that are confusing.	5	4	3	2	1
13. Students have a say in deciding the rules for classroom discussion.	5	4	3	2	1
14. Students try to make sense of other students' ideas.	5	4	3	2	1
15. The activities increase students' interest in your content area.	5	4	3	2	1
	Almost Always	Often	Sometimes	Seldom	Almost Never
16. Students get a better understanding of the world outside of school.	5	4	3	2	1
17. It's OK for students to voice concerns about anything that stops them from learning.	5	4	3	2	1
18. Students have a say in deciding how much time they spend on an activity.	5	4	3	2	1
19. Students ask other students to explain their ideas.	5	4	3	2	1
20. Students appear to enjoy the learning activities.	5	4	3	2	1
	Almost Always	Often	Sometimes	Seldom	Almost Never
21. Students learn interesting things about the world outside of school.	5	4	3	2	1
22. Students are free to express their opinion.	5	4	3	2	1
23. Students ask each other to explain their ideas.	5	4	3	2	1
24. Students appear to be confused.	1	2	3	4	5

25. What students learn has nothing to do with their out-of-school life.	1	2	3	4	5
	Almost Always	Often	Sometimes	Seldom	Almost Never
26. Students learning is isolated from the real world.	1	2	3	4	5
27. It's OK for students to speak up for their rights.	5	4	3	2	1
28. Students are given a say in how they will be assessed.	5	4	3	2	1
29. Students explain their ideas to each other.	5	4	3	2	1
30. Students appear to view the learning activities as a waste of time.	1	2	3	4	5
	Almost Always	Often	Sometimes	Seldom	Almost Never
31. What students learn has little to do with the outside world.	1	2	3	4	5
32. Students appear to feel like they should not speak freely.	1	2	3	4	5
33. Students have some input as to what will be on tests.	5	4	3	2	1
34. Students pay attention to each other's ideas	5	4	3	2	1
35. Students appear to feel tense.	1	2	3	4	5

Scoring Guidelines for Constructivist Learning Environment Questionnaire

This instrument consists of both positive and negative statements which teachers must answer on a scale that ranges from “Almost Always” to “Almost Never.” For positive item statements, the “Almost Always” choice would receive a 5 moving on down to the “Almost Never” choice which would receive a 1. For negative item statements, the numbering procedure is reversed. A ranking scheme will be used to categorize teachers' alignment with constructivist principles ranging from 7 to 35 points. A score of 7-13 indicates low agreement; 14-20, low intermediate agreement; 21-27, high intermediate agreement; and 28-35, high agreement.

I. Personal Relevance Scale

This scale is concerned with students' experience of the personal relevance of academic content. The scale has been designed to measure the extent to which students perceived the relevance of academic content to their out-of-school lives. From a constructivist perspective, the classroom environment should not promote a discontinuity between school learning and students' out-of-school lives by evoking an abstract and de-contextualized image of academic content. Rather, the classroom environment should engage students in opportunities: (1) to experience the relevance of academic content to their everyday interests and activities; (2) to use their everyday experiences as a meaningful context for the development of their formal learning.

Items:

- | | | | |
|-----|-----|-----|-----|
| 1. | (+) | 25. | (-) |
| 6. | (+) | 26. | (-) |
| 11. | (+) | 31. | (-) |
| 16. | (+) | | |
| 21. | (+) | | |

II. Critical Voice Scale

This scale is concerned with students' development as autonomous learners. In particular, the scale has been designed to measure students' perceptions of the extent to which they are able to exercise a critical voice about the quality of their learning activities. From a constructivist perspective, the classroom environment should not favor technical curriculum interest (e.g., covering the curriculum content) to an extent that accountability for classroom activities is directed largely towards an external authority. Rather, the teacher should be willing to demonstrate his/her accountability to the class by fostering students' critical attitudes towards the teaching and learning activities. This can be achieved by creating a social climate in which students believe that it is legitimate and beneficial (1) to question the teachers' pedagogical plans and methods; (2) to express concerns about any impediments to their learning.

Items:

- | | | | |
|-----|-----|-----|-----|
| 2. | (+) | 32. | (-) |
| 7. | (+) | | |
| 12. | (+) | | |
| 17. | (+) | | |
| 22. | (+) | | |
| 27. | (+) | | |

III. Shared Control Scale

This scale is concerned with another important aspect of the development of student autonomy, namely students sharing control of the classroom learning environment with their teachers. In particular, the scale has been designed to measure students' perceptions of the extent to which the teacher involves them in the management of the classroom learning environment. From a constructivist perspective, students should not be required to adopt the traditional role of compliant recipients of a predetermined pedagogy that is controlled entirely by the teacher. Rather, the teacher should invite students to share control of important aspects of their learning by providing opportunities for them to participate in the process of: (1) designing and managing their own learning activities; (2) negotiating the social norms of the classroom.

Items:

- 3. (+)
- 8. (+)
- 13. (+)
- 18. (+)
- 28. (+)
- 33. (+)

IV. Student Negotiation Scale

This scale is concerned with negotiation among students. The scale has been designed to measure students' perceptions of the extent to which they interact verbally with other students for the purpose of building their knowledge within the consensual domain of the classroom. From a constructivist perspective, the classroom environment should not require students to learn in social isolation from other students or to regard the teacher or textbook as the main arbiter of what counts as viable knowledge. Rather, the classroom environment should be concerned with engaging students in opportunities: (1) to explain and justify their newly developing ideas to other students; (2) to make sense of other students' ideas and reflect on the viability of their ideas; (3) to reflect critically on the viability of their own ideas.

Items:

- 4. (+)
- 9. (+)

- 14. (+)
- 19. (+)
- 22. (+)
- 29. (+)
- 34. (+)

IV. Student Attitude Scale

This scale has been included to provide a measure of the concurrent validity of the CLEQ. The attitude scale has been used extensively in research on science laboratory classes, and has an established reliability. The scale measures student attitudes to important aspects of the classroom environment, including: (1) their anticipation to the activities; (2) their sense of worthiness of the activities; (3) the impact of the activities on student interest, enjoyment and understanding.

Items:

- | | |
|---------|---------|
| 5. (+) | 24. (-) |
| 10. (+) | 30. (-) |
| 15. (+) | 35. (-) |
| 20. (+) | |

APPENDIX B

CONSTRUCTIVIST CLASSROOM OBSERVATION FORM (CCOF)

Teacher: _____

Observation Date: _____
Start Time: _____ End Time: _____

Class Information		1 st 10 min.	2 nd 10 min.	3 rd 10 min.	4 th 10 min.	5 th 10 min.
Period: _____ Grade: _____	Activity					
	Student Engagement					
	PR	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤
	SU	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤
	CV	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤
	SC	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤
	SN	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤
Constructivist Learning Principles						
AS	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	
Learning Director	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	
Pedagogical Experience						
Teacher Actions						
		Student Actions				

Notes:

Instructional Activity Codes

Instructional Activity	Code	Description
Teacher reads problem	TP	Teacher reads problem to group of students
Students read the problem	SP	Students read the problem in small groups
Student groups	GD	Students in small groups discuss facts, needs-to-know, action plan, and ideas/solutions
Teacher interacting with individual student	TIS	Teacher working with/talking to/helping individual student
Teacher interacting with small group	TIG	Teacher working with/talking to/helping small group of students
Technology use – students	TS	Technology being used by students for related learning activities
Other resources use – students	NTS	Other resources provided by teacher for related learning activities
Student presentation	SP	Student(s) presenting information to the class (either planned or on-demand)
Demonstration by teacher	D	Teaching demonstrating a procedure to the class
Questioning by teacher	Q	Teachers asking questions of student(s) in a group setting
Student responding	SR	Student(s) answering questions posed by teacher (choral response included in this category)
Manipulative	M	Student(s) working with concrete materials to illustrate abstract concepts
Seat work – individual	SWI	Student(s) working at desk on academic materials (independently)
Seat work – group based	SWG	Student(s) working at desk on academic materials (groups)
Cooperative learning	CL	Students working in a planned cooperative structure to complete a task
Technology use – teacher	TT	Technology being used by the teacher for presenting instructional content
Assessment activity	A	Students engaged in a formalized assessment activity (e.g., test; performance)
Teacher directed discussion	TDD	Teacher facilitates a whole class discussion
Teacher lecture	TL	Teacher provides lecture/students take notes
Other	O	List other activities

Student Engagement, Learning Principles, Learning Director

These are global ratings for each 10-minute segments. Thus, each segment will have only one rating of reach of these domains, the rating that is most representative of that time period for that group.

Student Engagement	Learning Environment Principles	Learning Director
1- very low engagement = 20% or fewer of students engaged in learning	PR – personal relevance SU – scientific uncertainty CV – critical voice	Who directs the learning, or makes the decisions about the learning activities. Use the following scale for making your segment ratings for the identified groups:
2 – low engagement = 21 - 40% of students engaged in learning	SC – shared control SN – student negotiation SA – student attitude	1 – teacher directs all the learning
3 – moderate engagement = 41 – 60% of students engaged in learning	Ratings are made in each segment following the given scale:	2 – teacher directs most learning
4 – high engagement = 61 – 80% of students engaged in learning	1 – not evident / negative 2 – somewhat evident 3 – evident / neutral	3 – teacher and student share learning decisions
5 – very high engagement = 81% or more of students engaged in learning	4 – represented 5 – well-represented / positive	4 – student directs most learning 5 – student directs all the learning

Pedagogical Experience

S – Successes = Record specific successes observed
O – Obstacles = Record specific obstacles encountered
L – Limitations = Note specific limitations

Class Information

Period = what period during the day class is taught
Grade = grade level of students

APPENDIX C

SEMI-STRUCTURED INTERVIEW QUESTIONS

- What is most influential in determining the direction for teaching and learning in your school? How do you know this?
- Describe the process that led to your decision to use project-based learning? What led you to learn about PBL instruction?
- What have you found to be important for creating a project-based learning environment?
- How do you know if project-based learning is successful?
- Do you have fears associated with using project-based learning in your classroom? Describe if any?
- What has been your level of support from outside your classroom? Administrative? Parental? Teachers? Resources?
- How has your training influence your development of project-based learning environments?
- Do you believe other teachers would be willing to use project-based learning? Why or why not?
- What recommendations would you give to other teachers about using project-based learning?
- Describe the process you go through to design instruction within the project-based learning framework?
- What is your role in a project-based learning environment? How is this similar/different than before?
- What are some specific examples of how to carry out your role?
- Who determines what activities go on in class?
- What are some difficulties/challenges in using project-based learning?
- What surprised you about how students worked/behaved in project-based learning environments?
- What differences have you noticed in student actions/behaviors?
- What types of discipline problems have occurred?
- How would you describe the students' participation in this environment?
- How do people learn?

- How does project-based learning engage students?
- In what ways does project-based learning accommodate student interests?
- How is the direction of student learning decided?
- In what ways do students exercise choice in the PBL environment?
- How is student-student discussion and reflection integrated into the PBL environment?
- Describe some examples of successful student learning resulting from project-based learning?
- Describe some examples of unsuccessful student learning resulting from project-based learning?

APPENDIX D

REFLEXIVE JOURNAL

September

Preconceptions. Research and experience influence my perspective on the implementation of project-based learning and will, undoubtedly, influence how I view its implementation through the experiences of the participant teachers. One issue to consider is my own experience as a teacher and how that has influenced my views on the concept of student engagement and the use of strategies commonly associated with project based learning. While I was not trained in the use of formal PBL protocols while I was teaching, my approach incorporated its common elements including a focus on real-world issues, an emphasis on student inquiry and collaboration, an allowance for student choice, and a focus on student products. My use of these ideas developed from the content rather than a pre-conceived learning philosophy. My belief in the PBL approach comes from that experience. However, a complicating concern is the idea of student engagement. In my experience as a teacher, and in my understanding as a researcher, student engagement is associated, not only with content, but with the activities in which students participate while interacting with content. It's in the design of work. In my content area as a teacher, engagement was less problematic than it perhaps is for math, social studies, science, and English teachers. Students largely chose to be in my classes and came to the class with some level of interest. In some cases, students came with a high level of interest and were part of my programs for multiple

years. However, while certain subjects may hold more intrinsic value for students, the organization of content by a teacher also plays a large role in student engagement. Again, the design for work matters. I know because as a first year teacher (more like the first two or three years), my default approach to teaching these subjects was very traditional and based on my own experience as a high school student. It also suppressed any natural interest in the content areas I taught with which students arrived in my courses. So in observing and interacting with teachers implementing PBL, my assumptions are that student engagement is something over which teachers do have some control because they control the design of work and how they interact with students. I believe this is true even in the core content areas like math and English language arts.

Also, I believe teachers expectations of and for students has an impact on their participation in the learning environment. My assumption as a researcher is that this can impact the implementation of PBL for better or worse. As a district administrator, I have been involved in previous discussions and evaluations in which it was evident that expectations for some students are chronically low. The study of a previous pedagogical framework based on inquiry and active student participation showed that one of the limiting factors associated with its use was teachers' beliefs that students lacked capacity to participate in inquiry-based learning environments. I don't believe that this is the case with the teachers associated with the current study. However, the current campus is part of the greater district culture in which the previous study was conducted.

Engagement. The constructivist classroom observation scale calls for an identification of the level of student engagement during each class observation. One potential confounding factors in understanding the data from observations is in the working definition of the construct of "student engagement" on the scale and the student engagement framework that underlies the study rationale. The observation scale assumes that student engagement is an observable element of student participation, and while components of the district's engagement framework are observable, the framework asserts that engagement is only knowable through teacher/student interaction; relationships. During several of the 10-minute increments, I will interact with students and ask questions to more fully understand engagement with the goal to at least better approach a full understanding of student engagement.

PBL protocol process. During the first round of observations, it was easy to see the PBL protocol process. Students were functioning in groups, teachers were moving among groups, conducting workshops. Also, students were already using the language and operational protocols of the learning model. Much of the discussion around the early implementation revolved around the idea that this was all process and no substance. One study teacher indicated that she felt like she hadn't taught math to this point (2 weeks in) and that it was all process. Part of this, I would suggest, is due to the necessity to teach students the protocols and part of it is due to the inquiry-based nature of PBL. There is also the likelihood that, this early in the process, there is still a large learning curve and/or not a full practical and/or conceptual understanding of the shift. (For instance, getting students to recognize "a need-to-know" is a major component of PBL. The

process to do this has little to do with the content or standards, and much to do with engagement, progress checking, and conversation). Also, content is not readily heard because the teacher is not typically addressing the whole group or lecturing; recognition of learning happens through progress checks, student demonstration, and student self assessment of learning.

Environment. What once seemed like plenty of space in several of the classrooms now seems cramped. PBL requires areas for various elements of the learning model including grouping/teaming of students in a way that allows for effective collaboration, cross-group collaboration and/or independent study and research, technology, and teacher and/or student led workshops. Also, desks seem to complicate the flexibility of the environment and, in one of the classes, inhibits physical movement around the room (another element of effective PBL is movement). Also, the general noise level increases in the room and my observation is that teachers, while recognizing this implication as necessary, may be a bit unsettled by it. One of the concerns teachers have is the inability of students to remain on task and, thus, being able to discern between productive noise and off-task noise. I have observed both, but probably a bit more of the off-task variety to this point.

October

Researcher's role. One concern would be the staging of instruction during my observations. However, the PBL environment is dependent upon a context that spans a greater length of time than my observations. While this potential is mitigated also by observing classes three straight days, the scope of inquiry learning is also beyond three

days. Finally, the environment is not predicated on what a teacher does but what students do, something more difficult to facilitate for observation purposes only. Also, while these observations are scheduled for the specific purpose of using the CCOF, I have conducted other walkthroughs and learning walks (alone and with other administrators) that, while it doesn't directly lend itself to the study, it indirectly informs my understanding of what I am seeing while using the protocols. Also, it is important that I ask myself the question, "Am I seeing what I want to see?" because while that is not the concern of the researcher, selling the initiative is part of my job. The real issue here is the learning itself. I can't create standards based learning because I want it to happen. Mastery of the standards and demonstration of learning through a product-focus and on assessments can't be faked.

Next, one of my roles is teacher support. Within the leadership framework or philosophy in which I work, this means less direction through power and authority and more in terms of strategic collaboration, meaning I work with teachers and learn as they do in this process. We talk through issues related to instructional design. An example is dealing with the dilemma of student work groups. One teacher, during the semester's first project, wasn't sure how to handle the fact that various groups were at different places in the learning process and, therefore, were not ready to advance to the Create protocol at the same time. Her dilemma is how to reconcile this, which is normal and to be expected since kids learn at different paces, with the inevitable need to move on. We discussed, I made a suggestion, and she liked the idea for this particular project. So, in working with them, there are examples of issues I can help influence or work through

that inform their practice. This is not always evident in work, but it might be evident in the larger process including the establishment of grading procedures, curriculum-based assessment practices (one teacher was allowed to restructure standards and the CBA for that grade/content level of customized to account for this), and other things.

Also, I am part of the training cohort with teachers although my training is designed from an administrator's perspective, it places me with teachers on issues related to PBL; design of instruction, facilitation, soft-skills assessment, standards rubrics, grading, and parent communication. My interaction with teachers regarding PBL is from a support standpoint, meaning encouragement and addressing conditions that support PBL. I am not conducting teacher evaluations or formal critiques of unit design (this is a part of the PBL implementation process.)

I am aware that I am seen as a lead on the PBL implementation as I have coordinated training schedules between Engage2Learn and the school, worked with our Engage2Learn coach on designing coaching days, been part of conveying the purpose behind inquiry learning model and the need to lift the level of engagement among our students, produced digital content and content for community and school media regarding student engagement and PBL, facilitated meetings to study soft-skills rubrics, conducted meetings with other districts regarding PBL implementation, interacted with the school board regarding issues related to systems design, student engagement and PBL. I have also worked with teachers to address the furniture and space design needs for classrooms, including access to technology.

My training in PBL also provides me with insight into the PBL protocols teachers are considering when designing instruction. I use the CCOF to observe general classroom activities with the theoretical and practical knowledge of the model.

Facilitation, structure and scaffolding, teacher concerns. I think facilitating the PBL process is difficult for teachers. They have expressed concern regarding the on-task behavior of students, particularly when teachers are conducting workshops. Workshops generally take place during the Research/Work protocol, during which time students are working, with teams, independently. This is where moving from a whole-class perspective in which the teacher controls the flow of information to one in which that is not necessarily the case either creates anxiety for the teacher in terms of students getting content and/or students actually not on task. Both of these concerns require increased structure in the beginning of PBL implementation because students lack self-regulated learning strategies and lack research skills in which they can connect inquiry and research with content objectives, project requirements, and the overall driving question. This is why greater scaffolding and more structure are also part of the recommendations made in the literature when moving to this type of environment. During in-semester PBL training and discussion with teachers, my position has been to encourage teachers to add structure to their designs to account for these concerns, and I have subsequently observed some added structure in designs including directed research, more direct instruction, and limited modeling of SRL strategies (in one teacher's classroom).

Soft skills. Through the first few weeks, I have observed little deliberate modeling of SRL strategies and/or soft skills, which are critical components for students being able to operate in a PBL environment and are critical outcomes for it as well. They are also among the things that make up the rationale for moving to this type of environment. As we moved toward the end of the first nine weeks, several of the teachers began to talk about the need for soft skills assessment and even grading to aid in facilitation and group assessment.

Observation protocol. I noticed in observing that one of the elements on the protocol, Critical Voice, was defined by the extent to which students feel that they are able to question the pedagogy. This has not really been observed at all, and I would speculate that the presence of an established, non-negotiable curriculum, the TEKS, and a pedagogical framework that has been adopted by the school make it difficult to question. In fact, students' acceptance of their traditional role in school may be so deep that it wouldn't even occur to them to question it. While some students ask why they have to "do PBL", my observation is that this is more about the shift in burden to the student, meaning students in our system have never been asked to inquire, research, or to analyze problems. The few who question PBL seem to be seeking answers to content questions, not challenging PBL on pedagogical grounds.

Learning curve. There is a learning curve for all of us associated with the implementation of the model. The initial training was like trying to catch Niagara Falls in a bucket. So the implication for teachers is that implementation is difficult and fragmented. As time passes, and teachers become comfortable with certain aspects of the

model, they become more able to recognize and consider other aspects. Implementation of PBL is like a dimmer switch. It takes time to get to full brightness. While I don't suppose this is unusual in implementations in schools, the learning curve exists for me as well. My observations, I think, become more sophisticated as the semester progresses and I am able to detect or interpret aspects of the learning environment with more skill. I would say that while observation of the constructivist learning principles is subjective, I suspect my standard for recognition and noting became progressively higher as my own learning and understanding developed.

November

Capacity. The PBL process seems to shine a light on teaching and learning that, heretofore, many could avoid. One teacher commented that unit design is the most critical aspect of the process and that it is difficult to facilitate a poor design. Essential for quality design is of PBL units and constructivist principles for teaching is deep understanding of content and deep understanding of content standards. Also, connecting content standards to student work processes is essential to ensure standards mastery. Finally, getting students to recognize their need to know requires frequent formative assessment of individual students and student teams. In general, I have observed less formative assessment than I would expect which raises concerns about student mastery of standards. While part of this is the PBL learning curve, it also is something this approach reveals about pre-existing practice. Good teaching, in general, involves effective assessment, content and standards literacy, responsive instruction and design (design never stops).

Efficiency factor. One thing I have taken to discussing with teachers working to implement PBL is the idea of an efficiency factor associated with learning the model and designing and facilitating instruction. There is so much information associated with learning the model that, early on, teachers lack a macro understanding of how various parts work together and, therefore, focus on specific aspects of implementation (often those most closely aligned with their experience) or adapt aspects of the model to pre-existing practices. This is expected, particularly focusing on specific aspects of the model (PLAN protocol vs CREATE protocol) but inhibits the impact of the environment until they can get to a place where there is fuller conceptual understanding. An example is the use of DIYs which are intended to be subject to student choice based on student self-assessment of learning but are widely used right now by teachers as mandatory, graded assignments. This suggests either misunderstanding, infancy in the model and, thus, adapting to pre-existing practices, or recalcitrance. Among the teachers in the study, it is typically misunderstanding or infancy or both. As time progresses through the nine-weeks, several of the teachers are slowly getting better as particular aspects of implementation. The implications are that as they get more experience, that experience leads them to recognize other aspects of the model or frees up working memory to learn about other aspects of the model. An example of the former is the use of formative assessment, not just to understand student learning, but as the main mechanism for getting students to self-assess and, thus, take responsibility for their learning, establish their own need to know, seek out DIYs, and request workshops. Another example is the recognition for assessment of soft skills to help achieve the same thing with students

who lack SRL strategies and to differentiate individual participation in group processes, particularly the final product. The other implication is simply a function of cognitive load. Complicating, or compounding implementation difficulty, these phenomena exist for the students as well, meaning there are two learning curves happening at the same time that impact each other and, thus, impact student learning.

Interviews. In conducting the semi-structured interviews, I was careful to remain a listener rather than engage in analysis with the teachers. There were many times that I wanted to respond to an answer with some advice, but decided that this was not the proper forum for that sort of interaction. My participation was more in clarifying questions or asking new questions depending on the how the interviews progressed. As will be shown in the discussion, the climate on this campus is very good and interactions and/or acceptance of others in the classroom is prevalent. The teachers I worked with were very inviting in terms of being in their classroom and interacting with me regarding instruction.